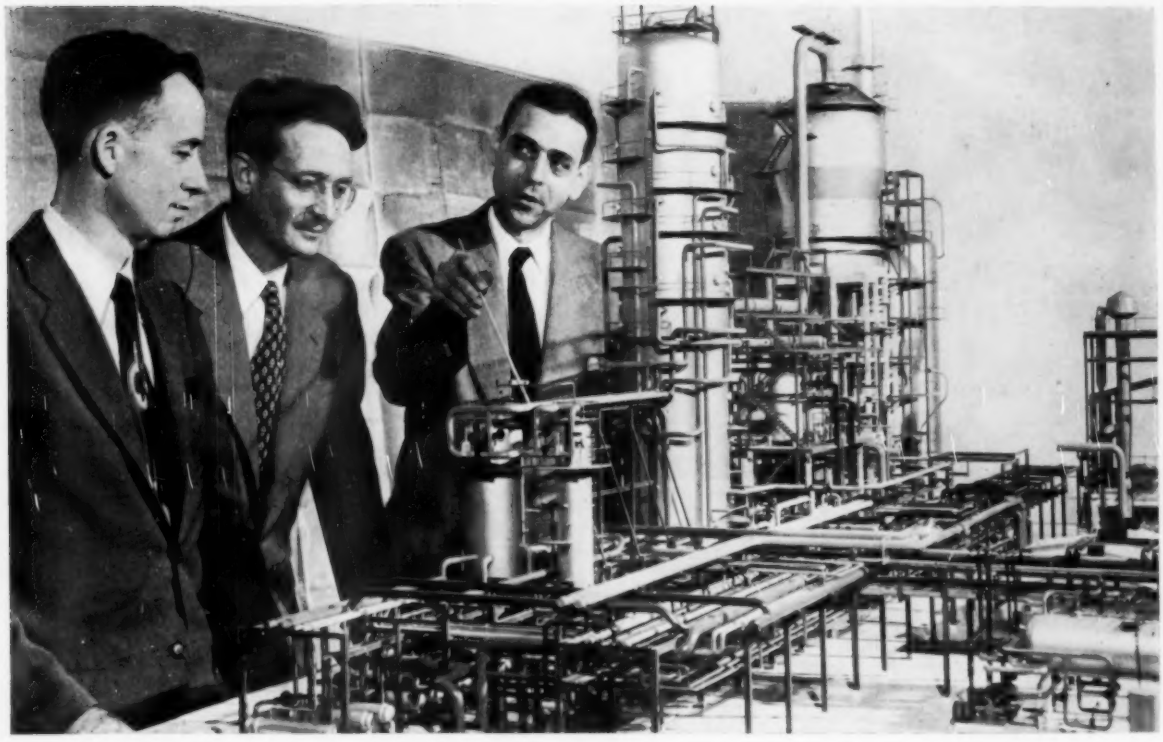
PETROLEUM PROCESSING

including Petrochemical Processing Section

FEBRUARY 1954



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How to Get Your Idea Across

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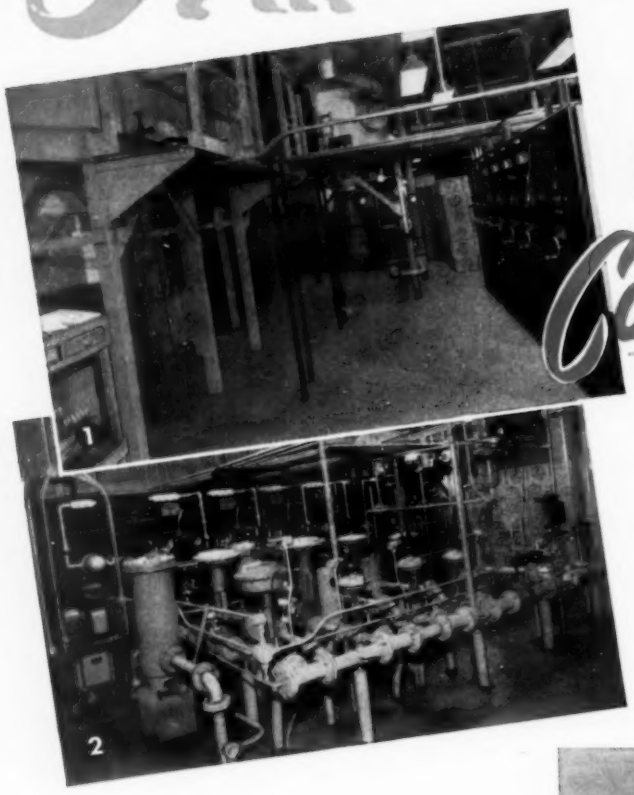
SINCLAIR *INCREASES OUTPUT...*

...with % PROPORTIONEERS %

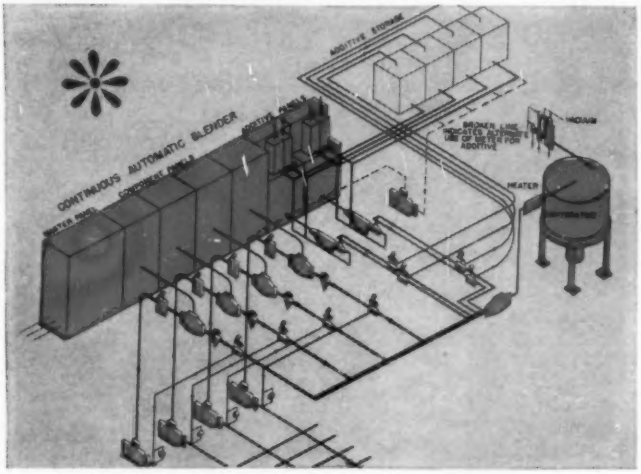
Automatic Compounding



This new %Proportioneers% installation at the Marcus Hook plant of Sinclair Refining Company utilizes phase control between components of lube stocks to reduce batch blending to completely automatic compounding. %Proportioneers% recirculation method permits exact presetting and control of component and additive ratios and allows quick adjustment of the total rate to production requirements without affecting these ratios. %Proportioneers% Continuous, Automatic Compounding makes possible greater flexibility between small and large quantity production with increased operating efficiency and new economies in material handling.

❶ %Proportioneers% compounding panels at right, additive storage upper left and flash evaporator in background.

❷ Back side of compounding panels showing control valves, recirculation system, and blend manifold.



✳ All equipment shown red in flowgram furnished by %Proportioneers, Inc.%

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The man who is never at his desk

The girl who answers the phone for one of Ethyl's automotive engineers must have a pretty frustrating job.

These men are almost never at their desk.

You see, helping bus, truck, and taxi-fleet owners get more efficient operation is not something you can do very well from an office swivel chair. So Ethyl automotive engineers spend the bulk of their time out in the field working closely with oil-company sales and technical people in their contacts with the service managers of fleets.

This offers two important benefits to refiners. Ethyl customers get quick and direct cooperation. At the same time, knowledge gained from direct contact with

(Continued on next page)

ETHYL
ANTIKNOCK COMPOUND
ETHYL CORPORATION

Printed in U.S.A.

The man who is never at his desk

(*Continued from preceding page*)

the field enables our laboratory people to keep research directed in the most productive channels.

Our "get out in the field" operation is by no means confined to our automotive men in the field. Engineers from Ethyl's Research Laboratories are constantly at work with farm-tractor people, passenger-car builders, and airplane-engine manufacturers on developments that in the long run may prove important to gasoline refiners and distributors.

These hours our men spend away from their desks are the most valuable hours. They provide the first-hand knowledge and experience that enable us to give refiners the most effective assistance.

We feel—and we think you'll agree with us—that reliable technical service is an important ingredient in Ethyl antiknock service.

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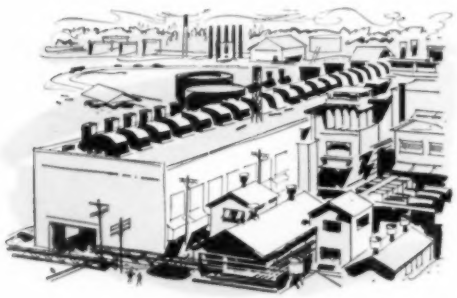
WORTH NOTING



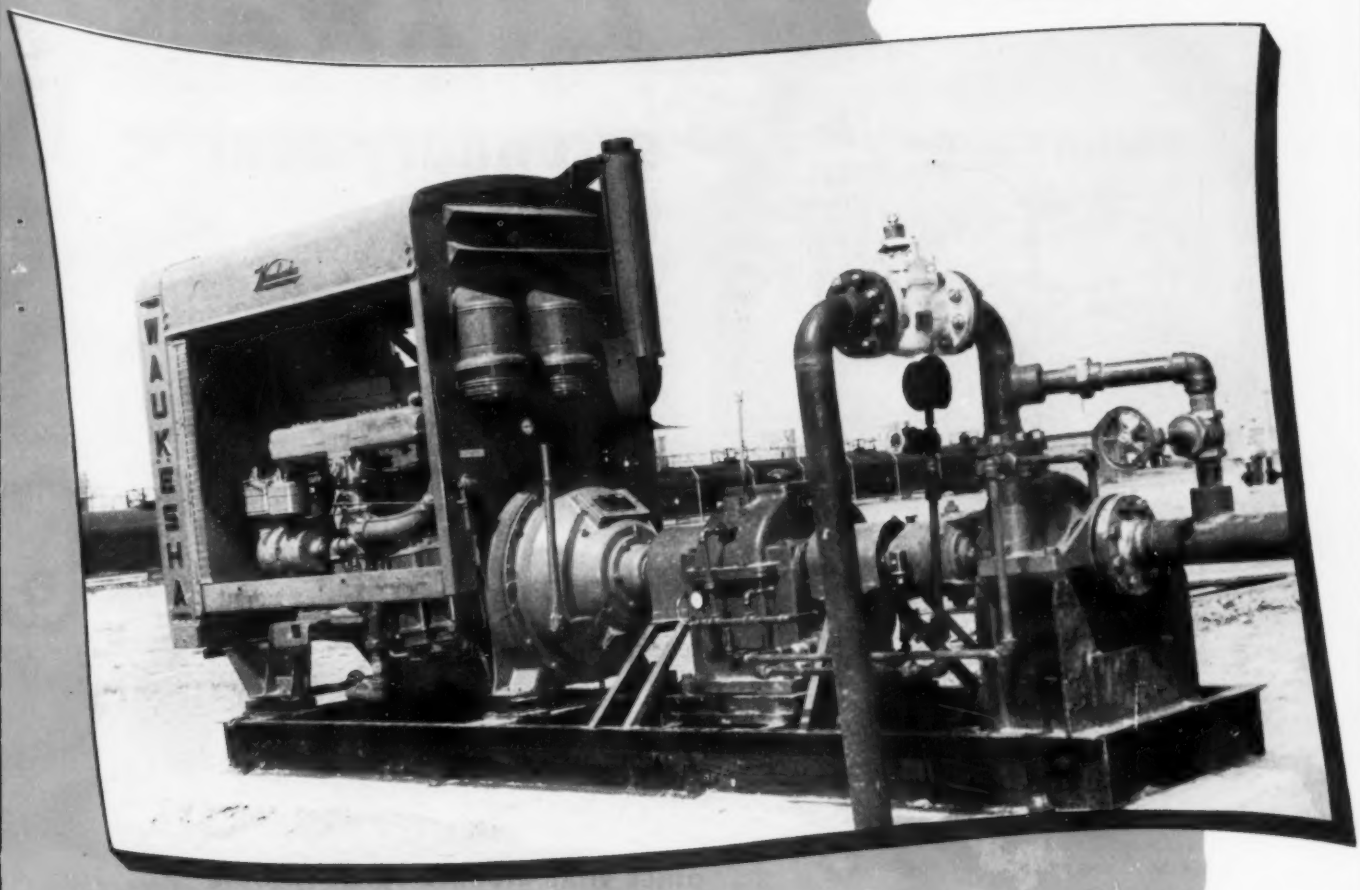
The largest sodium manufacturing facility in the world is part of the huge "Ethyl" antiknock compound plant at Baton Rouge, La.

31 years ago this month, the first sale of "Ethyl" gasoline was made in Dayton, Ohio. Ever since, Ethyl has continuously worked to expand the market for top-quality gasoline.

The "all weather" room at Ethyl's Detroit Research Laboratories can duplicate nearly any temperature, humidity and wind condition encountered in car operation.

Ethyl Service is backed by 31 years of antiknock experience

Do YOU have an Underground Storage Problem?



...then you'll be interested in this application of WILSON-SNYDER Type ES Centrifugal Pumps

Near Ulysses, Kansas, engineers of the Stanolind Oil and Gas Company decided that the most practical way to secure underground storage facilities for petroleum products would be to dissolve and wash out existing salt formations.

The unit pictured above was installed to handle this "wash-out" operation.

It consists of a Wilson-Snyder 3 x 4 x 13 Type ES centrifugal pump, rated at 500 gpm for a 693 foot head (300 psi) at 3550 rpm.

The pump is driven by a Waukesha 6-WAKU engine, direct-connected through a speed-increaser.

The entire assembly is mounted on a skid base and can be moved from one location to another as the progressive stages of this operation may require.

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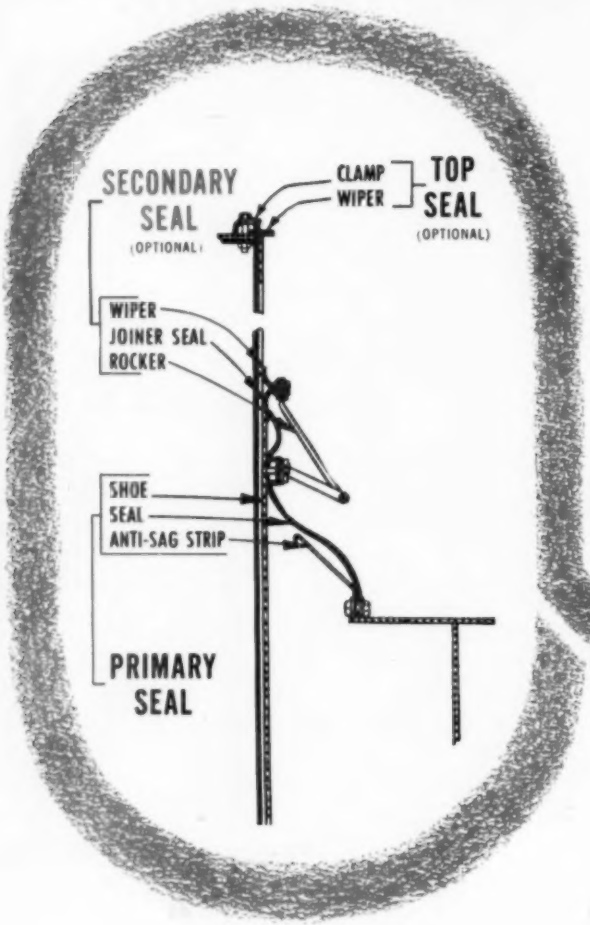
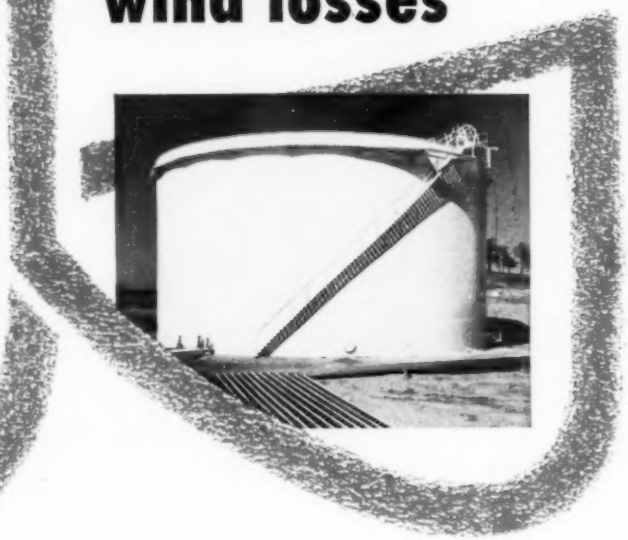
number 4 of a series



secondary seal to cut wind losses



Air currents cause a pulsating action above the primary seal which can draw vapor out of the area where the seal shoe contacts the shell.

Wiggins Floating Roofs have a Secondary Seal, a synthetic rubber coated fabric sealing ring riding against the tank shell above the primary seal. This patented Wiggins feature reduces wind action so effectively that it has been known to eliminate 50% of the evaporation losses suffered by tanks having only a single seal.

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(To obtain more data on advertised products see page 276)

PETROLEUM PROCESSING

Covering petroleum and petrochemical research and the design, construction, management, operation and maintenance of plants processing hydrocarbon materials into fuels lubricants and chemicals.

February, 1954
Vol. 9, No. 2

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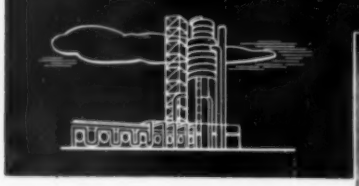
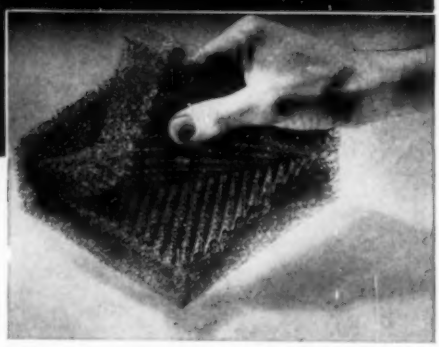
. . . Cutting Into Your Profits?

IF SO–GET THE FACTS ON METEX MIST ELIMINATORS!





Section of a METEX MIST ELIMINATOR, opened to show construction. They can be made of practically any metal, to combat corrosion. Factory cut to fit vessel dimensions and contour, there is no limit to the size in which they can be obtained.

Liquid entrainment need no longer be considered an unavoidable nuisance in processing operations, as more and more engineers are finding from experience. These *knitted* wire mesh entrainment separators literally "filter out" the entrainment (see diagram) and permit the gas to pass on, freed from the unwanted–and often contaminating–liquid.

METEX MIST ELIMINATORS can be easily installed in new or existing vessels. They require no special housings, equipment or power–and need no servicing or attention. They function over a wide range of velocities with a pressure drop usually so low it cannot be measured. Users report efficiencies of 99% and more.

METEX Mist Eliminators can be used wherever the problem of liquid entrainment exists. By effecting complete removal of liquids, Mist Eliminators contribute to more efficient and economical processing in such vessels as:

- VACUUM PIPE STILLS
- FRACTIONATING TOWERS
- KNOCK-OUT DRUMS
- EVAPORATORS
- ABSORBERS
- SCRUBBERS
- COMPRESSORS
- SEPARATORS
- STEAM DRUMS

Write TODAY for free catalog giving complete information and engineering data. Or tell us about your SPECIFIC entrainment problem. ←

When a gas is generated in or passes through a liquid (1), it carries with it on leaving the surface (2), droplets of entrained liquid. These droplets are carried upward by the rising gas stream (3). As the gas continually changes direction in passing through the pad, the droplets are impinged on the extensive wire surface. Here the droplets coalesce, forming large drops of liquid which break away (4) from the pad and fall back through the gas stream. The gas (5) passes on, freed from liquid entrainment.

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CATALYST CONTAMINATION CURED BY REMOVING ENTRAINMENT IN DISTILLATION UNIT

Equipment Costing $15,000 Pays Out In Under A Week For Large Southwestern Refinery

It was not a difficult problem to trace the cause of mounting catalyst losses to a cat unit feed so poor in color that it was essentially black. Entrainment of liquid from the bottom of the still column could be the only answer.

Here was a situation where a Metex Mist Eliminator would remove the entrainment – but what else might happen? Would this knitted wire mesh separator cause excessive pressure drop? How quickly would it become plugged by coke deposits and make the column inoperable?

Calculations by one engineer showed that the total cost of installing a 25-ft diameter Mist Eliminator, including designing and erecting supports within the still, was approximately $15.000 – less than a week's catalyst loss. After considerable study the decision was made, and the Mist Eliminator installed during the next routine turnaround.

When the first run of cat unit feed came from the remodeled crude distillation unit, it was crystal clear and water white. Throughout the normal run no differential pressure across the screen was found.

The problem was solved. Catalyst losses dropped sharply. And the Mist Eliminator has paid for itself in a matter of days.

Have you really analyzed your entrainment costs, and checked the savings a Mist Eliminator could make for you? Perhaps you are losing valuable end products in the exhaust stream. Perhaps you have a nuisance contamination problem. Perhaps the entrainment created in one vessel is causing trouble in a subsequent operation. For entrainment is an inevitable result of most processing and refining operations.

Metex Mist Eliminators perform just one function–and they are doing it in more and more refining vessels every day. They remove liquid entrainment–efficiently and economically–wherever it may occur.

Why not write today for more information on Metex Mist Eliminators. Or better yet, send data on your particular entrainment problem. We'll be glad to have our engineers check this, and send you our recommendations and suggestions.

PETROLEUM PROCESSING

Publisher's Page

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"Trends" in a New Dress, a New Spot

WE'VE got something new for you this month. Just a few pages beyond this column (pp. 161-163), you'll find an improved version of our regular "Operating Trends" department, giving you the current picture on refinery operations, supply and demand.

The charts, tables and text have been revised to accentuate further the data that show the current trend of plant operations in relation to product supply, demand, and inventories. The new "Trends," however, will continue to use the basic method of projecting the official Bureau of Mines' reports through the API weekly reports on refinery operations, to keep this vital information up-to-date for refiners.

Among the new features you'll now find in "Trends" is a table of weighted monthly average refinery prices for gasoline, distillates, kerosine, residual fuel oil and other products. These prices are compared with those for the previous month and for the same month a year ago, to indicate the general movement of wholesale prices. Another guide we've added to help the individual refiner in planning his own plant operations is a series of tables showing regional data for crude runs and product inventories. These tables give this information separately for each of the refining districts in the country.

The information that you'll find in "Trends" is, in our opinion, pretty important stuff—particularly for the fellow concerned with the day-by-day refinery operations. It's of significance to more people than only the oil company economist or statisticians, whose job it is to read graphs and columns of figures. A widening differential between refinery gasoline and distillate prices, for example, may forewarn an alert plant operator that a change in the refinery processing schedule is due. Widely unbalanced inventories may point to changes in yields or in the volume of runs to stills.

We like to look on "Trends" as something akin to a ship's compass. It will tell accurately whether the industry is holding to an even course in relation to product supply and demand, or veering off to one side. We hope that many more of you will find "Trends," in its improved dress, of interest and value to you in your work.

William F. Bland

Editor

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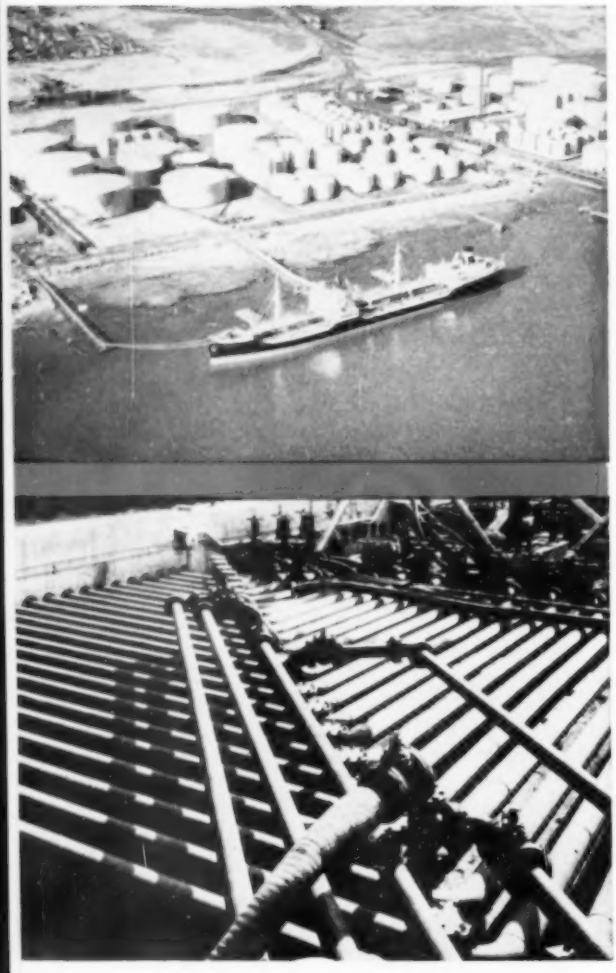

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What's Happening...

In Refinery Expansion

. . . **Tide Water Associated** will build a new 10,000 b/d combination sulfur removal and platforming unit at its Avon, Calif. refinery. The unit will remove over 90% of natural sulfur and other impurities by catalytic treating of naphtha feed stock before it goes to the reformer. C. F. Braun & Co. is construction contractor under licensing arrangements with Universal Oil Products. By-product hydrogen sulfide gas will be used for making sulfuric acid at an adjoining plant owned jointly with Monsanto Chemical Co.

. . . **Imperial Oil Co.** will rebuild most of its existing refinery at Imperoyal, near Halifax, Can., and increase crude capacity from 22,000 b/d to 41,625 b/d. Cost will be between $25,000,000 and $30,000,000. Work will start early in 1955. New installations will include a 27,000 b/d Fluid "cat cracker," atmospheric and vacuum distillation unit, catalytic polymerization unit, gas recovery plant, treating plant and a naphtha specialty plant.

. . . **Allby Asphalt & Refining Corp.,** a new firm, has acquired a 150-acre tract in Hammond, Ind., on which it will build an asphalt plant with an initial capacity of 50,000,000 gallons per year and storage capacity for 8,000,000 gallons. Raw materials will be received by pipeline from refineries in the East Chicago, Hammond and Gary area. The project is a joint operation of two other asphalt refineries, Byerlite Corp. of Cleveland, and Allied Materials Corp., Oklahoma City.

. . . **Ashland Oil & Refining Co.** is planning a catalytic reforming unit for its Catlettsburg, Ky., refinery, a large catalytic cracking plant for Findlay, Ohio, and modernization and enlargement of the Louisville refinery, a company financial report states. It has not yet been decided which project will be scheduled for 1954.

. . . **Salt Lake Refining Co.,** subsidiary of Standard of California, will install propane treating facilities of 260 b/d capacity at its Salt Lake City refinery. A new distillation column will remove carbonyl sulfide and sulfur after propane has been treated in existing girbotol and caustic scrubbing unit.

. . . **Standard of Indiana** will add a 3750 b/d catalytic reforming (Ultraforming) unit to its Casper, Wyo., refinery. Lummus Co. is prime contractor.

. . . **Great Northern Oil Co.,** proposing to build a refinery in the Twin Cities area of Minnesota, is assured 10 years' supplies of medium gravity Saskatchewan crude, J. R. Parten, Great Northern chairman, announced in Houston. Commitments have been made by Socony-Vacuum Exploration Co., Woodley Canadian Oil Co., and Southern Production Co. at rate of 20,000 b/d. William J. Carthaus, Tulsa, vice president of Deep Rock Oil Corp., has resigned to become president of Great Northern.

. . . **Washington Processing Co.** has arranged financing for a $10,000,000 refinery at Tacoma, it is announced, subject to dredging by Port of Tacoma to make site in tidal flats area available. Plans call for initial capacity of 10,000 b/d and 25,000 bbls. eventual, using crude brought by tanker, probably from terminal of Trans-Mountain Oil Pipeline, near Vancouver, B.C.

. . . **Imperial Oil Co.** will build a lubricating oil plant at its Edmonton refinery, the first in western Canada for the large-scale manufacture of lubricants. Capacity will be 2000 b/d of automotive and industrial oils. The $15,000,000 construction program will include adapting some of the refinery's existing units to provide raw materials for the new lube plant.

In Petrochemicals

. . . **Cosden Petroleum Corp.** and **Phillips Chemical Co.** have in operation at the aromatics plant of the Cosden refinery at Big Spring, Texas, a fractional distillation unit to produce para-xylene, of 5,000,000 lbs. per year capacity. Process was developed by Phillips and operates on mixed xylenes. Para-xylene is oxidized to terephthallic acid, starting material for du Pont's Dacron synthetic fiber.

. . . **Chillicothe Chemical Mfg. Co.** will build a $17,000,000 anhydrous ammonia plant near Chillicothe, Texas, using natural gas as raw material.

. . . **Standard Oil Development Co.** has established a new laboratories unit, Enjay Laboratories Division, to provide sales technical service in the petrochemicals field. New division will work on petroleum additives, solvents, chemicals and polymers marketed by Enjay Co. Dr. Miller W. Swaney will be director.

. . . **Shell Chemical Co.** has formed a new ammonia division to handle the manufacture, distribution and sale of ammonia, ammonium sulfate and related products to agriculture and industry. Shell's second ammonia plant in California, at Ventura, started running in December.

. . . **The petrochemicals plant at Naphthachimie et Cie,** at Lavera, France, is operating commercially on a new ethylene oxide process designed by Scientific Design Co., New York. The process uses the direct oxidation route in place of the conventional use of chlorine as an indirect oxidant. Design capacity is 17,000,000 lbs. of ethylene oxide annually.

. . . **Hercules Powder Co.** will build a $4,000,000 plant to make dimethyl terephthalate, basic material for one

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

of the new synthetic fibers, on the site of its synthetic resin facilities at Burlington, N.J. The manufacturing process to be used is an outgrowth of a laboratory technique for the oxidation of xylenes. The company has acquired the rights to use the basic chemistry of the air oxidation process for the production of DMT from California Research Corp.

. . . **Allied Chemical & Dye Corp.'s** Semet-Solvay Petrochemical Division has opened its new plant at Tonawanda, N.Y., for manufacture of polyethylene products. It will use ethylene derived from gas produced from fuel oil in a Semet-Solvay installation. Polyethylene output will be 20,000,000 lbs. annually. The ethylene plant was designed and built by Lummus Co.

. . . **Production of synthetic resins** for plastic raw materials in 1954 will approximate 3,150,000,000 lbs., an increase of about 5% over 1953, the Society of the Plastics Industry states. This is nearly 5 times the 1943 production of 653,332,000 lbs. The 1954 value of all plastics products will be $1,575,000,000, the Society estimates. Increasing supply of raw materials is chief factor responsible for the growth of plastics. By the end of 1955, Society says, in place of two companies, six will be making polyethylene.

In Natural Gasoline

. . . **Gulf Refining Co.** will build and operate a joint $10,000,000 conservation project in the Krotz Springs gas condensate field of St. Landry Parish, La., to handle 200,000 Mcfd of gas, of which half will be cycled and half processed for recovery of 9300 b/d of butanized condensate, butane and propane. By unitization it is estimated that 27,500,000 bbls. of liquid hydrocarbons will be recovered over conventional methods. Other joint owners are Humble and The Texas Co.

. . . **Cities Service Oil Co. (Del.)** will build and operate a joint 55,000 gal/day natural gasoline and LP-gas plant to serve the West Seminole field of Gaines county, Texas. Other owners are Atlantic Refining, Burdell Oil, Magnolia, Sinclair, Shell, Superior Oil and the Great Western Drilling Companies. Delta Engineering Corp., Houston, is the contractor.

In Markets and Prices

. . . **There was considerable backing and filling** in refined oil markets during the first month of 1954. Light fuel oils were quick to respond to the cold wave which swept the eastern half of the country in mid-January. Demand rose sharply, and prices in coastal markets and some of the interior refining districts regained ground lost earlier in the heating season.

. . . **Gasoline and lubricating oil prices** continued downward, reflecting surplus inventory positions in most refinery districts. In Western Penna., base lubricating oil prices dropped as much as 3¢/gal. following reduction in Penna. grade crude oil prices in amounts ranging from 29¢ to 35¢/bbl. on first day of 1954.

. . . **Distillate stocks** experienced a record 30-day drop of 20 million bbls.—from mid-December to mid-January. In the Gulf Coast market, cargo prices for kerosine rallied 0.25¢/gal., to 9.125¢, and No. 2 fuel also was up 0.25¢, to 8.37¢. At New York harbor, barge prices for No. 2 fuel rose from 9.15¢, to 9.7¢/ gal.

. . . **Gasoline stocks,** on the other hand, were up 22 million bbls. from year ago, and product was weak in virtually all primary supply markets. At the Gulf, cargo lots of 87 oct. regular-grade were offered at 10.75¢, down 0.25¢. In the Mid-Continent, 84 oct. regular-grade was quoted 0.125¢ lower at 11¢.

. . . **Penna. bright** stock dipped 1¢, to 17¢/gal., and neutral oils were off 2 to 3¢ with 25 pour test 200 vis. oil at 20¢. South Texas red and pale oil prices were down 1 to 1.75¢/gal., and solvent oils were weak both at the Gulf and in the Mid-Continent.

. . . **Heavy fuel** continued to buck the general price trend in the Mid-Continent with quotations for No. 6 oil up 5¢, to $1.50/bbl., Group 3.

Looking Ahead

. . . **Large expansion of catalytic reforming in the U.S.** will depend on whether the automotive industry applies the future increases in compression ratios to secure fuel economy, or continues to use them to emphasize acceleration and top speed in heavier cars, W. M. Holaday, Director of Research, Socony-Vacuum Laboratories, told the SAE annual meeting in Detroit. In the former instance, the increases in miles per gallon possible with 98 octane fuels, together with the saving in crude requirements in supplying these fuels, would furnish an economic incentive for refiners to install facilities to make the 98 octane fuels. Refiners' present plans will soon provide 500,000 b/d catalytic reforming capacity, said Mr. Holaday.

. . . **It's more than an even chance** that Shell Oil Co. in five years or so will build a refinery in the Minneapolis-St. Paul area, if the Williston Basin fields in Montana and the Dakotas develop as anticipated and a crude line is laid eastward, according to J. G. Jordan, marketing vice president of Shell.

. . . **Expanding lube oil production from Anglo-Iranian** Oil Co.'s British refineries will be felt in the export business of U.S. refiners, which is now at a declining rate. The Llandarcy, South Wales, plant of Anglo-Iranian has stepped up its lube oil output from 350,000 to 700,000 bbls. annually. Its new Isle of Grain refinery by the end of the year will be producing lubes at the rate of 980,000 bbls. annually. About 40% of Britain's lube oil consumption of 4,900,000 bbls. annually has been coming from the U.S.

Manning the centralized graphic control panel of the ultra-modern refinery of International Refineries, Inc. at Wrenshall, Minnesota, only three operators per shift completely control the processing of 11,000 B/D of Canadian crude oil.

This outstandingly economical arrangement is indicative of a new concept in refinery design, resulting in a financially profitable small refinery in an area where one had not previously existed.

To meet the special requirements of this situation, we at Lummus combined imagination and process ingenuity with a half century of engineering experience. We integrated Distillation, Model IV Fluid Catalytic Cracking, Gas Recovery, Treating and Catalytic Polymerization into a plant operated as one unit. We made flow of oil continuous, minimizing intermediate storage, pipes, pumps and tanks — made controls centralized and self-acting.

For International, this means a refinery low in initial investment (somewhere around $750 per barrel) and operating costs; one balanced to meet today's needs of the area it serves, but flexible for future changes—a successful solution of their specific problem.

Perhaps this demonstrates how the Lummus approach to a problem may contribute to the success of your next petroleum or chemical project.

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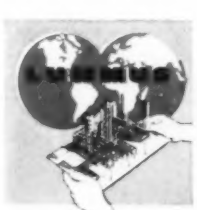

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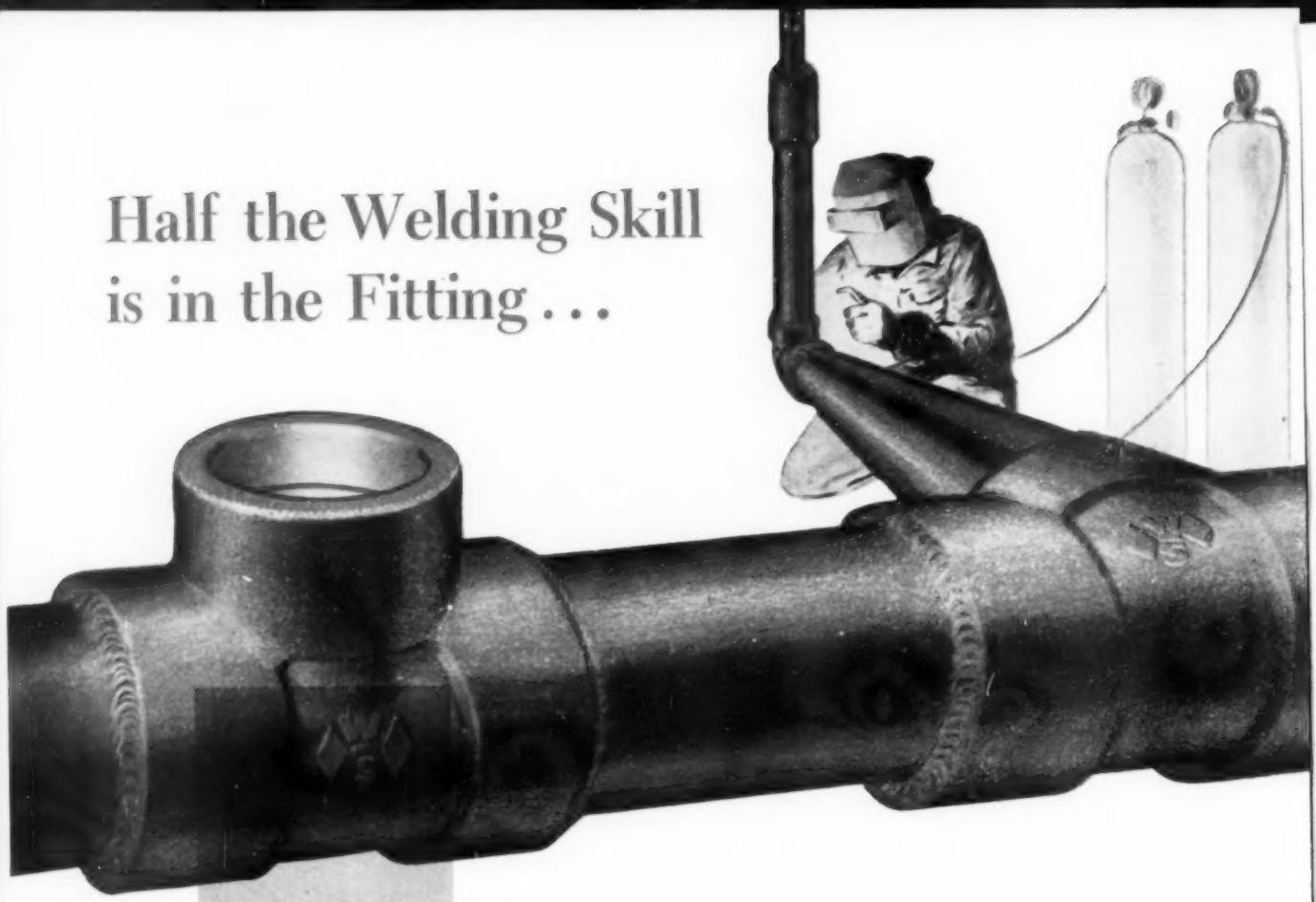

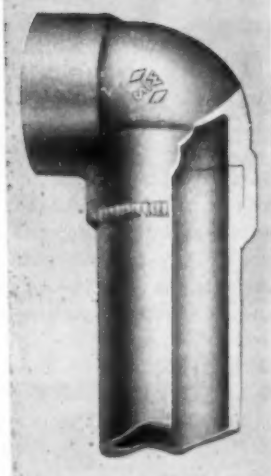

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3. Ample "come-and-go" in socket makes fussy accurate measurement and cutting of pipe unnecessary.

WATSON-STILLMAN FITTINGS are drop forged of highest quality steel to produce the well-known forged-fiber structure for maximum strength against pressure, temperature, shock and vibration. Extra strength is built-in in other ways, too—such as the extra reinforcement of long bands extending well beyond the bottom of the socket.

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Chemical Makers Exploring Routes To Acetylene Through Gas

INCREASED activity in the study of acetylene as a future building block for a host of industrial organic chemicals is coming mainly from the chemical manufacturers. This is natural, since they are familiar with the manufacture of this material from calcium carbide.

In terms of the volume contemplated for the future, the synthesis of acetylene from natural or refinery gases is looked upon as the economic method of production. One report estimates demand for acetylene by 1955 will reach close to 1,000,000,000 lbs. a year and by 1960 will be nearly double that figure.

Vinyl chloride, neoprene, trichloroethylene and acrylonitrile are seen as the immediate volume chemicals to be produced from acetylene, with acrylonitrile probably the fastest growing in demand. Acetylene is also seen as the starting point for other basic organic chemicals now awaiting economic means of production.

Existing and presently projected manufacturing facilities are entirely in the hands of the chemical manufacturing companies, except for the demonstration plant of the Wulff Process Co. near Los Angeles. This plant thermally cracks hydrocarbon feed stocks (at present, propane from natural gas) in a specially designed regenerative furnace.

Among the seven other acetylene producers in the U.S. three will have plants operating on natural gas using variations of the Sachsse partial oxidation process. These include Monsanto Chemical Co.'s plant at Texas City, now operating, Carbide and Carbon Chemical's plant, also at Texas City, and an acetylene unit which will be a part of American Cyanamid's $50,000,000 nitrogen chemicals plant, building near New Orleans. The other four acetylene producers in this country use calcium carbide entirely as raw material. Some authorities believe that natural gas, soon to be the source of about 10% of our acetylene production will, with some refinery gases, be the source of 75% of our output in another 20 years.

The Wulff demonstration plant now turns out about 3000 pounds per day of acetylene, which is shipped in containers for welding purposes. For the manufacture of chemical acetylene it is considered that plants would have to have a capacity of 20,000,000 lbs. a year or higher.

A recent study of the Wulff process places the required investment for a plant of this capacity operating on propane, at nearly $2,990,000, and at about $3,400,000 for a plant feeding natural gas. Such a plant could make acetylene from gas at a cost of about 6 cents a pound and from propane at about 6.75 cents a pound.

These plants, it is estimated, could produce acetylene from hydrocarbon feed stocks at a cost about half that of making the material from calcium carbide. In the Southwest and some other areas, this differential would be higher because of the lower costs for hydrocarbon feed stocks and higher cost of calcium carbide.

Acetylene has long been recognized in the laboratory as the starting point for a large number of important industrial chemicals. Now that its manufacture as a petrochemical is a reality, it seems likely that some oil companies will want to have a hand in its development. In fact, Phillips Petroleum and Continental Oil are already looking into it. —V. B. G.

High Costs for Reclaiming Used Lubricating Oils

THE work some railroads are doing in re-refining and refortifying the used crankcase oils from their Diesel locomotives, emphasizes the cost and the careful techniques required to produce a reclaimed oil approaching a fresh oil in quality, even under the most favorable conditions.

The program of the railroad maintenance departments in this field is described in the 1953 report on the Symposium on Diesel Locomotive Engine Maintenance sponsored by the American Locomotive Co.[1] The symposium was held last May, in Schenectady, N.Y., but the report of the proceedings has just recently been released.

In their oil reclaiming work, the railroads have the help and cooperation of their oil suppliers. For railroads not mixing brands of crankcase oils and blending the re-refined oil with the same type of additives as in the original new oil, the oil suppliers are furnishing a concentrate containing the same blend of additives as in the new oil.

On the cost of reclaiming the used Diesel oil, the report states, "the cost of re-refining may vary from 12 to 20 cents per gallon of oil produced. Fortification may vary from 5 to 10 cents. Therefore, the cost of restoring used crankcase oil to its original quality can cost from 17 to 30 cents a gallon, depending on the type of oil, type of additive, procedures and efficiency of the reclaiming plant." The amount of oil lost in reclaiming varied up to 15%, it was further reported.

At the invitation of the American Locomotive Co., technical representatives of eight major oil companies met separately with the railroad maintenance people to discuss their oil reclaiming program. After the procedure was presented, one oil company technologist said the restored oil would be as good as fresh oil, five said the oil would be satisfactory if the efficiency of the reclaiming procedure was consistently maintained, one said the oil would be satisfactory if brands were not mixed, and one thought the restored oil would not be as stable to oxidation.

One pertinent comment referred to the practice of some railroad maintenance departments in using spectrographic analyses of crankcase oils to determine engine wear. Where a large amount of wear products are left in the reclaimed oil, it was found difficult to use the spectrograph as a tool for determining engine condition.

Some of the railroads are operating their own re-refining equipment, others have their crankcase drainings processed by a commercial reclaimer. Procedures used in both instances are basically the same, crank-

case drainings are mixed with clay and heated in a boiler or retort to 500-600°F. The fuel oil and water vapors formed are passed through a water-cooled condenser and the water and fuel collected in a separate tank. Then the hot crankcase oil is dropped from the retort. Sometimes it is mixed with a filter aid and/or neutralizer. It is then pumped through a filter press to remove the clay and other contaminants.

Some railroads use the re-refined oil without additives for lubricating switch engines. In some instances it is mixed with new oil without the addition of additives. Most of the roads are fortifying the oil with additives similar to those in the fresh oil

The subject of reclaiming used lubricating oils is one on which information as to costs and quality of product has in many cases been misleading. The Alco technical staff and the railroad maintenance departments have gone into the subject in a thorough and comprehensive manner, with the aid of the lubricating oil manufacturers. Their present report is an important contribution in this field, on which authentic technical literature has been scanty. It is to be hoped that they continue with these reports. —V. B. G.

(1) Report on 1953 Symposium on Diesel Locomotive Engine Maintenance, American Locomotive Co., Schenectady, N.Y.

Lower Operating and Plant Costs By Not Prilling Ammonium Nitrate

NEWEST wrinkle in ammonium nitrate manufacturing, workable whether or not the ammonia and nitric acid are of petrochemical origin, is illustrated in Commercial Solvents Co.'s new 200 tons a day plant at Sterlington, La. Most nitrate plants produce the fertilizer as an aqueous solution, evaporate the water and prill the product to prevent caking. CS has ducked the prilling step by evaporating the water during the neutralization.[1]

Up to the point of neutralization CS's Sterlington plant is not particularly unusual, except that ammonia is made in another plant several miles away and ultimately will be received by pipe line. Inescapable is the chemical fact that the products when ammonia and nitric acid react are ammonium nitrate and water. At this point comes the new wrinkle.

At Sterlington, the packed neutralizing vessel or reactor is also an evaporator, producing a molten stream assaying better than 99% NH_4NO_3. The pure salt melts at 337° F. and decomposes at around 410°. Consequently, the reactor is held close to 400° F. by using the high exothermic heat of neutralization, at which temperature both reactants are sure to be vaporized and water vapor produced will remain that way. Steam and any nitrogen oxides are swept out with a stream of air. A separator forming the top of the vessel knocks back any molten salt entrained in the rising vapors.

The molten ammonium nitrate from the reactor is deposited on a Sandvik belt, broken into chunks and conveyed to a hammermill, after which it is cooled and screened. Oversize material returns to the hammermill, undersize is returned to the reactor. Following screening, the product is coated with diatomaceous earth. Particles are larger than those produced by prilling, but are said to be equally as free-flowing.

Reportedly the reason this technique has not been used heretofore is the supposed danger of handling ammonium nitrate at the high temperatures likely to result during neutralization and the likelihood of decomposing the product even if there were no accompanying explosion. CS has a patent (U. S. 2,568,901) covering its method of getting around these hazards, feels that operating costs will eventually be lower than involved in conventional methods; capital investment is less, too. Plant is said to be flexible enough to allow tailoring the product to customer needs. —D. P. T.

(1) *Chemical Week*, P. 50, Oct. 24, 1953.

Rise of Income Distribution Tags Future Growth of Petrochemicals

THE astounding growth of the petrochemical industry in the past 30 years has fast outstripped the growth of U. S. population. While population has gone up about 1.5% annually since 1923, petrochemical manufacture has jumped 20 to 30% each year.

On the other hand, there has been a remarkable change in the distribution of income in this period, according to studies made by O. A. Colten of Shell Chemical Co. and reported by him at the recent Southwest Regional Meeting of the American Chemical Society in New Orleans. Mr. Colten noted, for example, that in 1929 only a third of the families in the U. S. had incomes exceeding $3000/yr. By 1953, two-thirds of the families were in this bracket—on the basis of corrected dollars. In the $4000-$10,000/yr. group there were 6 million families in 1929, 20 million in 1953.

Thus, there were not only more purchasing units in each succeeding year, but incomes were sufficiently greater so that these units could purchase more than just the bare necessities of life.

Concurrent developments in chemical technology and industrial engineering, possibly by fortuitous circumstances, brought petrochemistry to the fore just at a time when it could mesh into this period of income growth.

A case in point is the growth in demand for ammonia to supply fixed nitrogen for explosive and fertilizers. Fixed nitrogen from coal can grow only as fast as the steel industry—a growth which has been relatively small. From 1945 on, synthetic ammonia production has been "sky-high"—from 500,000 tons in 1945 to 2,000,000 tons in 1953.

Synthetic resins are another example. Annual output has jumped in 25 years from 10,000,000 lbs. to about 2,500,000,000 lbs., and the estimate for 1975 is 9,000,000,000.

The same tale could be told of many more petroleum-derived chemicals, too numerous to mention.

The point to take home is that this fabulous progress could not have taken place without customers. And the growth in customers was a natural outcome of the growth in income. —D. P. T.

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Letters

Corrosion Costs

TO THE EDITOR: We found the article on costs of corrosion in the November issue of PETROLEUM PROCESSING (pp. 1685-88) extremely interesting. The figures listed showing the costs in comparison to the number of barrels of crude processed are astounding and should be a challenge to all of us to reduce our corrosion rates.

It is, however, a bit difficult for us to realize that the cost of our corrosion in the refinery would run as high as shown in the article since our corrosion rates do vary over a wide range. In other words, there are places in our operating units where corrosion rates are extremely high which are taken care of by alloys and/or inhibitors. There are other locations within the refinery, such as storage tanks, where corrosion rates are established but are extremely low and, in many cases, we have tanks that are 30 or 40 years old.

In trying to tie the corrosion rate into maintenance costs, there may be a direct relationship, but we question if it would run as high as 70%. In our own company we use the 9¢/bbl. rate as the possible refinery cost and, based on our maintenance costs for the year 1952, we arrive at a figure of 55.5% of our total maintenance.

In other words, if we were to make a rough estimate as to what these corrosion costs are, we would say that it would probably be in the neighborhood of 50-60%. There is, however, a great deal that all companies could do to arrive at a more realistic cost.

Your article does point out quite forcefully that these costs are high and that management can afford to spend a large amount of money to help reduce them.

H. F. WEST
Chief, Gen'l Engrg. Div.
Manufacturing Dept.
Standard Oil Co. (Ohio)
Cleveland, Ohio

TO THE EDITOR: . . . Whether we accept Prof. Uhlig's estimates or Dr. Speller's values, corrected for inflation, the amount of money chargeable to corrosion is large.

The methods of arriving at these values are perhaps less important. However, the comments by Mr. LaQue should not be lightly dismissed. Surely the results of corrosion research

(To obtain more data on advertised products see page 276)

have paid some dividends, even if we charge the cost of such research to corrosion itself.

On the other hand, new processes, more corrosive crude oils, and the advent of petrochemicals continue to present new corrosion problems. In addition, it is equally important to make new employes corrosion-conscious. Thus, the continuing articles as promised in the "box" in your November issue will be a welcome series. We shall look forward to reading them.

LESTER M. GOLDSMITH
General Manager,
Engrg. & Const. Dept.
Atlantic Refining Co.
Philadelphia, Penna.

TO THE EDITOR: . . . The article is an excellent summary and provides some very interesting numbers. Corrosion as defined by Mr. Watts is one of the major operating problems in processing. However, we do concur with Mr. LaQue that significant reductions in relative cost have been achieved.

Articles of this type serve a very useful purpose in focusing attention on and providing incentive for research on the general problem. We look forward to continuing reports of this nature.

LEWIS GROSS
Taylor Oil and Gas Co.
Corpus Christi, Texas

TO THE EDITOR: . . . There is no doubt that corrosion is a very serious and costly problem to the petroleum refinery. In our own case, our corrosion bill is much less than the average because we refine almost exclusively the so-called sweet crudes. We spend relatively little in the actual replacement of vessels and lines because corrosion has exceeded the safe limits. This is due to our practice of preventive maintenance and a rigid inspection schedule.

We combat corrosion by metallurgical research, which studies continuously the conditions which cause corrosion and suggests practical solution of our corrosion problems.

We watch the progress of corrosion in our plants through the activities of an organization of plant corrosion engineers. These are resident engineers specifically assigned to our main plant units who keep dependable records of the progress of deterioration of our plant equipment from whatever source.

When excessive deterioration is discovered, immediate steps are taken to overcome the conditions responsible.

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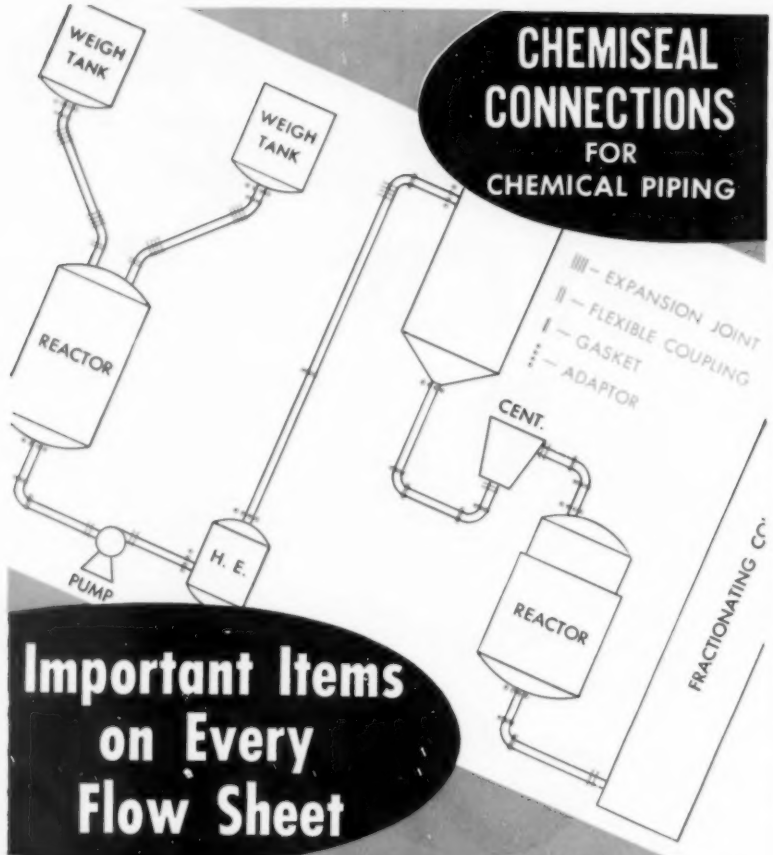
 (To obtain more data on advertised products see page 276)



Whatever the pipe-to-pipe or pipe-to-equipment sealing problem—whatever the materials of construction or flange specifications—whatever the mechanical or thermal shock or movement involved—there are engineered Chemiseal Connections to fill the bill.

CHEMISEAL GASKETS include Teflon*-Jacketed, soft filler types for Corning-conical flanges and glass lined steel connections; Snap-on type gaskets molded from Teflon to match contour of conical-end glass pipe; Teflon cut gaskets, available either as ring or full face gaskets for all standard pipe flanges or for irregular shaped openings.

CHEMISEAL EXPANSION JOINTS—utilizing a Teflon Bellows of several convolutions, and permitting maximum axial expansion and contraction of piping. Connect unlike piping ends and nozzles without gaskets or adaptors.

CHEMISEAL FLEXIBLE COUPLINGS—close-coupled expansion joints with only two bellows convolutions. Particularly suited for absorption of vibration and correcting slight misalignments of piping.

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It is our experience that we can usually find a solution before irreparable damage has occurred. Each case is considered on its own merits. The solution may be in the category of metallurgy, in chemically inhibiting, or in process changes to eliminate the physical condition responsible for the deterioration.

I attribute the effectiveness of our corrosion control program to the very close liaison among engineering, operating, and maintenance departments. The benefits which we derive are much greater than the savings in the corrosion bill itself, because we realize a higher productivity from our units through continuity of operation at high through put rates.

PAUL D. BARTON
Chief Engineer
Sun Oil Co.
Philadelphia, Penna.

TO THE EDITOR: . . . I have no comment on the 8¢/bbl. corrosion cost figure since I have no figures for reference. However, in general, I believe this article is an excellent one for emphasizing the importance of this problem.

P. E. DARLING
Chief Refinery Engineer
Pan American Refining Corp.
Texas City, Texas

Petrochemicals

TO THE EDITOR: "Petrochemical Processing," a new editorial section started last year as a major addition to the editorial content and scope of PETROLEUM PROCESSING, gives me, as well as many another I believe, new knowledge and valuable information.

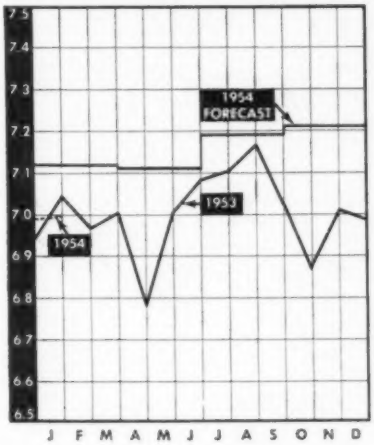
Because of the petroleum and gas industry being the great natural source of supply, petrochemical processing has developed into a large scale operation. Oil men and business men in your country invested vast quantities of manpower and dollars in research and in plant facilities to make this development possible. I believe that it will have an unlimited future.

As one of the men connected with the petroleum industry of China, I am most eager to seek knowledge about plastics, synthetic fibers, detergents, and many other new chemical products derived from petroleum and natural gas.

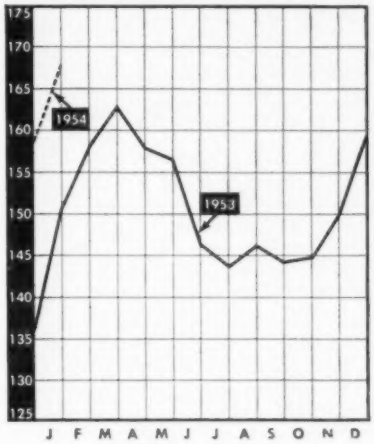
WANG TZE-SENG
Chinese Petroleum Corp.
Kaohsiung Refinery
Kaohsiung, Taiwan
China

 (To obtain more data on advertised products see page 276)

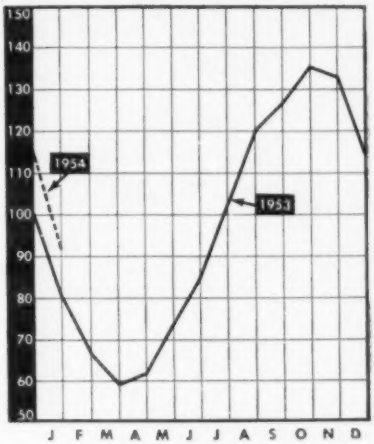
CRUDE RUNS TO STILLS
(Millions of b/d, monthly averages)



PRIMARY GASOLINE STOCKS
(Millions of bbls., end of month)



PRIMARY DISTILLATE STOCKS
(Millions of bbls., end of month)



Heavy Pull on Heating Oil Stocks

OUTLOOK: High product stocks will continue to hold down crude runs—Otherwise U. S. gasoline stocks could reach 185,000,000 bbls. by spring—Plenty of cushion still in heating oil inventories.

WITHDRAWALS of distillate fuels from refiners' storage in the early part of January were much heavier than a year ago in the East Coast district, which is long on inventories. Drafts were a little higher than in 1953 in the interior districts.

Overall stocks of distillate and kerosine Jan. 1 were large enough to indicate that refiners can meet demand the rest of the heating season without now stepping up crude runs to much over 7,000,000 b/d avg.

Holding down runs to stills and increasing the yield of distillates, if required, at the expense of gasoline output, would put something of a brake on the buildup of gasoline stocks, which could climb to 185,000,000 bbls. for the U. S. by March 31, more than 20,000,000 bbls. above the 1953 peak.

Heating Oils: Combined primary stocks of kerosine and distillate fuels east of California Jan. 16 were 112,145,000 bbls., 9,645,000 bbls. higher than the 102,500,000 bbls. in storage Jan. 17, 1953. From Jan. 17 to March 28, 1953, these inventories were reduced by 33,275,000 bbls. and stood at 69,225,000 bbls., considerably higher than on the comparable date in 1952.

The same reduction this year would bring these inventories east of California on March 27 to 78,870,000 bbls., a top-heavy volume for the end of the winter. The rate of stock withdrawals will be higher this year, however. Under present operations, refiners are producing less kerosine and distillates than in early 1953. To make up for the lower output might require for around 7,500,000 bbls. more to be taken from storage by March 27. More burners are to be serviced and the weather may be colder in coming weeks. However, inventories could be below the 1953 figure and still be a safe overall backlog for the area.

KEY STATISTICS
(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Jan. 1954	Dec. 1953	Jan. 1953
CRUDE OIL			
U.S. Production	6.198	6.130	6.555
Imports	.606	.575	.616
U.S. Stocks	269.576*	271.554	272.250
Runs to Stills	7.001	6.991	7.042
GASOLINE			
Refinery Output	3.487	3.532	3.384
Refinery Demand	3.187	3.322	2.997
Primary Stocks	167.781*	158.920	150.518
HEATING OILS			
Refinery Output	1.894	1.828	1.961
Refinery Demand	3.138	2.598	2.697
Primary Stocks	115.435*	144.042	104.142
RESIDUALS			
Refinery Output	1.232	1.211	1.307
Imports	.441	.428	.502
Total Supply	1.673	1.639	1.809
Refinery Demand	1.773	1.685	1.916
Primary Stocks	47.247*	49.542	45.910

*Jan. 1954 Crude Oil Stocks as of Jan. 16; other stocks as of Jan. 23.

PRODUCT and CRUDE PRICES
Products—¢/gal., weighted average prices in principal refinery markets
Crude—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	Jan. 1954	Dec. 1953	Jan. 1953
Gasoline	12.10	12.17	11.33
Distillate	9.03	8.95	8.53
Kerosine	10.37	10.30	9.94
Residual	4.24	4.21	3.41
Above 4 Products	9.20	9.21	8.46
Lube Oils	17.14	17.53	20.82
Crude	2.82	2.83	2.56

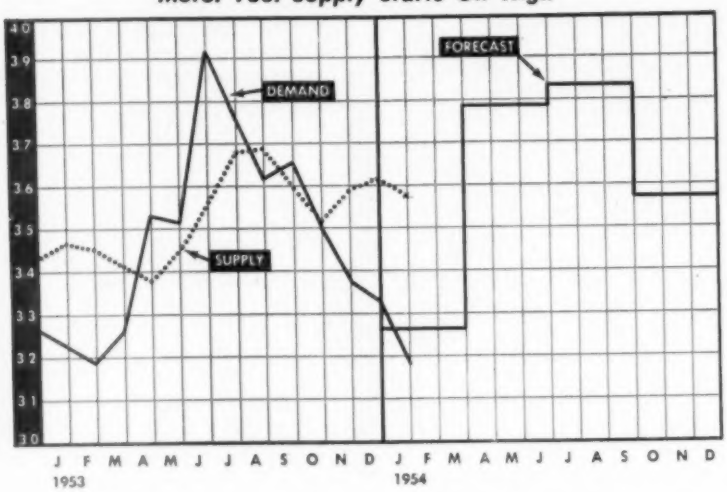
REFINERY YIELDS
% on Crude Runs to Stills

	Jan. 1954*	Dec. 1953	Jan. 1953
Gasoline	45.3	45.9	43.7
Kerosine	5.8	5.4	6.2
Distillates	21.2	20.7	21.7
Residuals	17.6	17.3	18.5

* Through Jan. 23.

SOURCE OF DATA (except prices): current and preceding month, API weekly reports; earlier months, Bureau of Mines.

Motor Fuel Supply Starts Off High



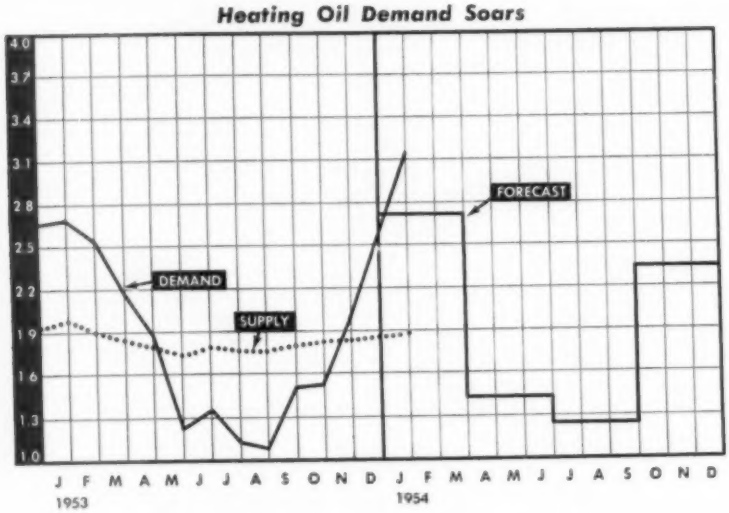
MOTOR FUEL

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
Jan. '54*	3.177	.395	3.572
Jan. '53	3.084	.381	3.465
Change	+.093	+.014	+.107
% Change	3.0	3.7	3.1
TOTAL SUPPLY (Millions of bbls.)			
12 Mos. '53	1,147.772	142.885	1,290.657
12 Mos. '52	1,052.018	137.763	1,189.781
Change	+95.754	+5.122	+100.876
% Change	9.1	3.7	8.4

DEMAND (including Exports)(Million of b/d)	
Jan. '54*	3.187
Jan. '53	2.997
Change	+.190
% Change	6.4
TOTAL DEMAND (including Exports)(Millions of bbls.)	
12 Mos. '53	1,266.912
12 Mos. '52	1,191.114
Change	+75.798
% Change	6.3

* Through Jan. 23.

Heating Oil Demand Soars

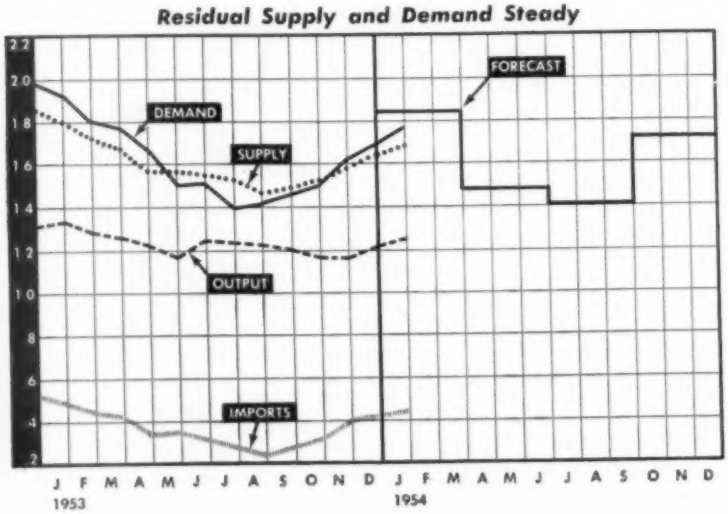


HEATING OILS

	Kerosine	Dist. Fuels	Total
PRODUCTION (Millions of b/d)			
Jan. '54*	.406	1.488	1.894
Jan. '53	433	1.528	1.961
Change	−.027	−.040	−.067
% Change	6.2	2.6	3.4
TOTAL PRODUCTION (Millions of bbls.)			
12 Mos. '53	129.675	532.456	662.131
12 Mos. '52	132.300	521.264	653.564
Change	−2.625	+11.192	+8.567
% Change	2.0	2.1	1.3
DEMAND (including Exports)(Millions of b/d)			
Jan. '54*	.640	2.498	3.138
Jan. '53	.564	2.133	2.697
Change	+.076	+.365	+.441
% Change	13.6	17.1	16.4
TOTAL DEMAND (including Exports)(Millions of bbls.)			
12 Mos. '53	127.581	521.281	648.862
12 Mos. '52	132.546	513.680	646.226
Change	−4.965	+7.601	+2.636
% Change	3.7	1.5	0.4

* Through Jan. 23.

Residual Supply and Demand Steady



RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
Jan. '54*	1.232	.441	1.673
Jan. '53	1.307	.502	1.809
Change	−.075	−.061	−.136
% Change	5.8	12.2	7.5
TOTAL SUPPLY (Millions of bbls.)			
12 Mos. '53	447.583	133.956	581.539
12 Mos. '52	454.784	128.510	583.294
Change	−7.201	+5.446	−1.755
% Change	1.6	4.3	0.3

DEMAND (including Exports)(Millions of b/d)	
Jan. '54*	1.773
Jan. '53	1.916
Change	−.143
% Change	7.4
TOTAL DEMAND (including Exports)(Millions of bbls.)	
12 Mos. '53	586.251
12 Mos. '52	583.784
Change	+2.467
% Change	0.4

* Through Jan. 23.

SOURCE OF DATA: Current and preceding months, API weekly reports; earlier months, Bureau of Mines.

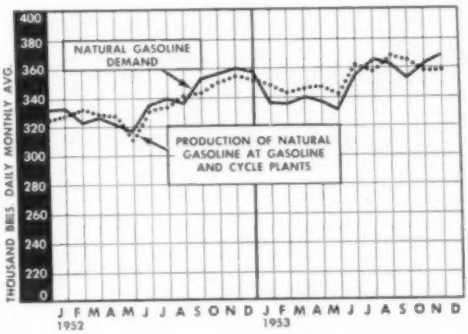
RUNS TO STILLS and DISTRIBUTION OF PRIMARY STOCKS BY U.S. REFINERY DISTRICTS

(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d, average for week ending on date shown) Jan. 23 1954	Jan. 23 1953	Change	% Change	GASOLINE STOCKS (Millions of bbls., on date shown) Jan. 9 1954	Jan. 10 1953	Change	% Change	RESIDUAL STOCKS (Millions of bbls., on date shown) Jan. 9 1954	Jan. 10 1953	Change	% Change
East Coast	1.019	1.088	— .069	6.3	34.827	31.889	+ 2.938	9.1	11.438	12.575	—1.137	9.0
Gulf Coast	2.248	2.271	— .023	1.0	33.114	27.329	+ 5.785	21.1	7.761	8.787	—1.026	11.6
Total Coastal	3.267	3.359	— .092	2.7	67.941	59.218	+ 8.723	14.7	19.199	21.362	—2.163	10.1
Appalachian	.210	.212	— .002	0.9	6.440	5.971	+ .469	7.8	1.059	.839	+ .220	26.2
Ind.-Ky.-Ill.	1.316	1.310	+ .006	0.5	33.414	30.633	+ 2.781	9.1	4.480	5.110	— .630	12.3
Okla.-Kans.-Mo.	.557	.592	— .035	5.9	17.342	15.748	+ 1.594	10.1	1.115	1.427	— .312	21.9
Other Inland	.580	.605	— .025	4.1	16.422	13.728	+ 2.694	19.6	2.346	2.228	+ .118	5.3
Total Inland	2.663	2.719	— .056	2.1	73.618	66.080	+ 7.538	11.4	9.000	9.604	— .604	6.3
Total East of Calif.	5.930	6.078	— .148	2.4	141.559	125.298	+16.261	13.0	28.199	30.966	—2.767	8.9
California	1.088	.953	+ .135	14.1	20.784	15.376	+ 5.408	35.3	21.469	17.910	+3.559	19.8
Total U.S.	7.018	7.031	— .013	0.2	162.343	140.674	+21.669	15.4	49.668	48.876	+ .792	1.6

District	DISTILLATE STOCKS (Millions of bbls., on date shown) Jan. 9 1954	Jan. 10 1953	Change	% Change	KEROSINE STOCKS (Millions of bbls., on date shown) Jan. 9 1954	Jan. 10 1953	Change	% Change	TOTAL HEATING OIL STOCKS (Distillate plus Kerosine) (Millions of bbls.) Jan. 9 1954	Jan. 10 1953	Change	% Change
East Coast	41.059	34.459	+ 6.600	19.1	13.042	11.675	+1.367	11.7	54.101	46.134	+ 7.967	17.2
Gulf Coast	16.424	15.131	+ 1.293	8.5	4.323	4.577	— .254	5.6	20.747	19.708	+ 1.039	5.3
Total Coastal	57.483	49.590	+ 7.893	15.9	17.365	16.252	+1.113	6.9	74.848	65.842	+ 9.006	13.7
Appalachian	2.200	2.173	+ .027	1.2	1.146	.799	+ .347	43.4	3.346	2.972	+ .374	12.6
Ind.-Ky.-Ill.	18.106	17.150	+ .956	5.6	7.159	5.425	+1.734	31.9	25.265	22.575	+ 2.690	11.9
Okla.-Kans.-Mo.	10.242	10.758	— .516	4.8	1.498	1.557	— .059	3.8	11.740	12.315	— .575	4.7
Other Inland	5.292	4.450	+ .842	18.9	1.020	1.090	— .070	6.4	6.312	5.540	+ .772	13.9
Total Inland	35.840	34.531	+ 1.309	3.8	10.823	8.871	+1.952	22.0	46.663	43.402	+ 3.261	7.5
Total East of Calif.	93.323	84.121	+ 9.202	10.9	28.188	25.123	+3.065	12.2	121.511	109.244	+12.267	11.2
California	13.305	10.885	+ 2.420	22.2	.400	.341	+ .059	17.3	13.705	11.226	+ 2.479	22.1
Total U.S.	106.628	95.006	+11.622	12.2	28.588	25.464	+3.124	1.2	135.216	120.470	+14.746	12.2

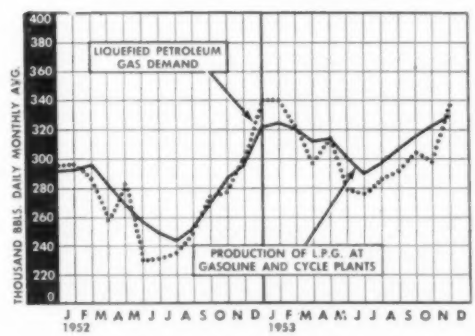
Supply and Demand of Natural Gas Liquids



Natural Gas Liquids Statistics

(Source: U.S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	Supply* (1000 bbl./d avg.) Natural Gasoline	LPG	TOTAL	Demand** (1000 b/d avg.) Natural Gasoline	LPG	TOTAL
Nov. '53	359	330	689	367	337	704
Nov. '52	356	295	651	360	300	660
Change	+3	+35	+38	+7	+37	+44
% Change	0.9	11.9	5.8	1.9	12.3	6.7
	Total Supply (1000 bbls.)			Total Demand (1000 bbls.)		
11 Mos. '53	118,258	104,123	222,381	116,791	101,341	218,132
11 Mos. '52	112,173	90,353	202,526	112,531	88,881	201,412
Change	+6,085	+13,770	+19,855	+4,260	+12,460	+16,720
% Change	5.4	15.2	9.8	3.8	14.0	8.3



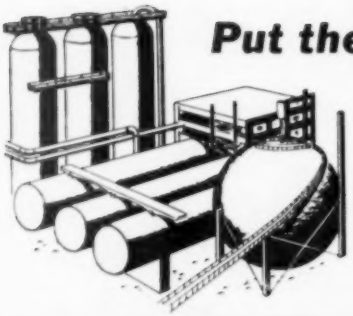
Stocks, End of Month (1000 bbls.)

	By type of product (At gasoline plants and terminals only) LPG	Natural Gasoline	Condensate	Finished Gasoline†	By Location Gasoline Plants	Refineries	Total
Nov. '53	4,973	3,223	310	1,467	9,973	2,250	12,223
Oct. '53	5,172	3,739	229	1,266	10,406	2,787	13,193
Sept. '53	4,420	3,819	257	1,201	9,697	2,939	12,636
Nov. '52	2,744	2,133	294	1,287	6,458	2,126	8,584

* Supply includes receipts from refineries as well as current production from natural gasoline and cycling plants. Receipts from refineries in November included 178,000 bbls. of natural gasoline.

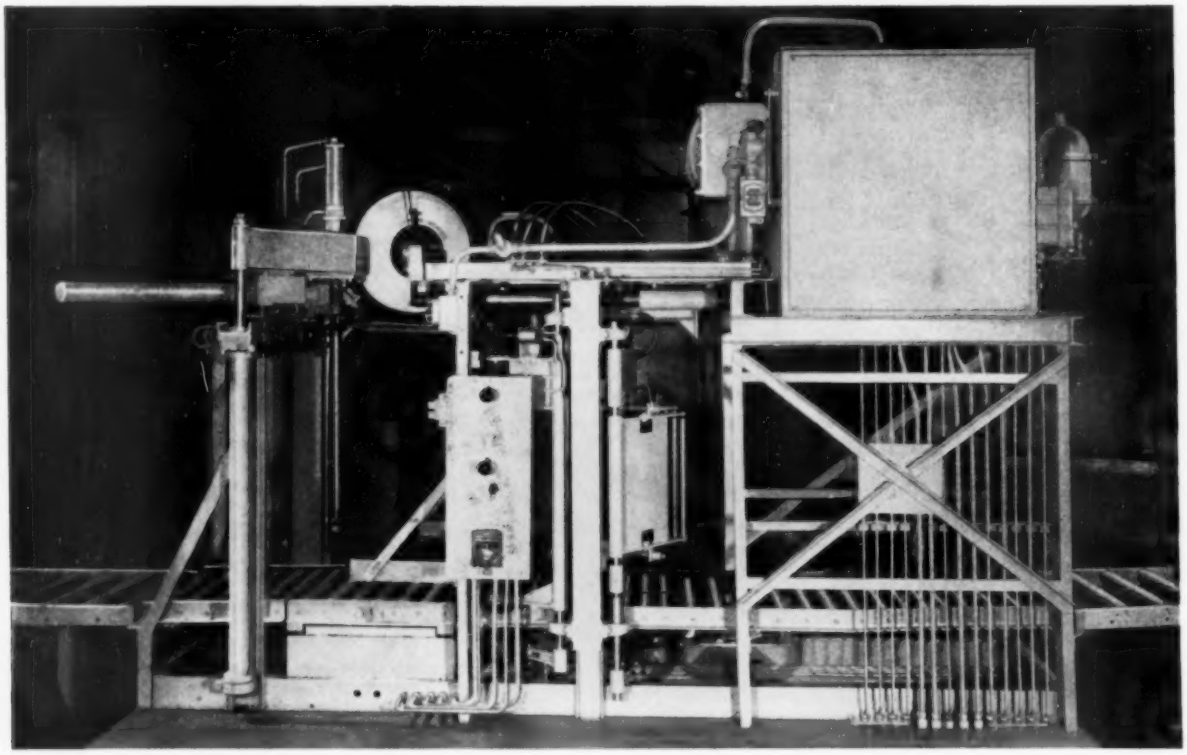
** Demand does not include liquefied refinery gases produced for fuel and chemical purposes, which totaled 2,784,000 bbls. in November.

† Includes naphtha and other products.



Put the Rucker AUTOMATIC DRUM FILLER on Stream · Saves time

Cuts labor costs · Reduces overfill losses
Minimizes explosion and toxic hazards



THE RUCKER AUTOMATIC DRUM FILLER completely eliminates manual handling of drums during the filling operation. Manned by a single attendant, this unit accepts drums, locates and positions bungs, fills, weighs and releases drums at a rate that assures maximum efficiency and economy. *By actual test, the Rucker Automatic Drum Filler more than triples the output of an average manual filling station.*

Precision-engineered for complete flexibility, the Drum Filler permits quick change-over from one product to another through fast, easy interchange of filling lances. It automatically compensates for variations in drum heights, diameters and tare weights; and reduces overfill to an absolute minimum.

Submerged filling, accomplished by a hydraulically-controlled lance, minimizes foaming and prevents static spark discharge. **All electrical equipment and wiring conforms to Class 1, Group D specifications for operation in hazardous areas and the unit is being applied by major oil companies for the handling of gasoline and other volatile fluids. Special stainless steel lances are available for filling corrosive materials or products for human consumption.**

When the volume at a given filling station does not require the speed and capacity of the Automatic Drum Filler, the efficiency and economy of the station can be substantially increased by the Rucker Semi-Automatic Drum Filler. The Semi-Automatic unit may be converted to full automatic operation if desired.

Write for full information on these high-efficiency units. We will welcome an opportunity to furnish proof of the ability of our equipment to cut packaging costs on any operation.

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PETROLEUM CHEMICALS DIVISION NEWS

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February ★ One of a Series of Interest to the Petroleum Industry ★ 1954

DEALERS will be able to keep him sold on your brand of gasoline with the aid of this new Du Pont folder.

Giving a satisfactory answer to poor starting complaints is a tough proposition for the average dealer. To help him handle the situation in a salesmanlike way, this new 4-page folder will give him the answers he needs—in a short, clear-cut fashion that is easy to remember.

Ask your Du Pont Petroleum Chemicals Division representative for a sample copy and information on obtaining a quantity for your dealers.

New, Comprehensive Booklet on Antioxidant Sweetening Now Ready

Since antioxidant sweetening offers many cost reduction and quality advantages over other sweetening methods, many refiners have asked us for technical information on the subject.

To fill these requests, Du Pont has prepared a comprehensive booklet on antioxidant sweetening. It contains more information on this process than ever before published in a single volume.

Cost-Saving Data

The booklet gives information on how you can reduce operating and sweetening equipment costs through the use of Du Pont Antioxidant No. 22. It also shows how you can reduce loss in gasoline or octane number through the efficient use of the process . . . as well as sweeten and inhibit your product in a single step.

Helpful Hints

The booklet fully explains the variables encountered in antioxidant sweetening. Helpful hints on how to control these operational variables for best results are also included. These will help you save considerable time and money in getting the process started in your refinery.

This basic, authoritative text on antioxidant sweetening is yours for the asking. Address your request for "Antioxidant No. 22 Sweetening" to any of the Du Pont Petroleum Chemicals Division regional offices.

Du Pont Publishes New Book on Medical Aspects of Tetraethyl Lead Operations

The first and only book of its kind . . . produced as an aid to refinery medical personnel

There has long been a need for a book of specialized information on the medical aspects of tetraethyl lead handling. With this in mind, three of Du Pont's physicians who specialize in tetraethyl lead problems have collaborated in bringing out a volume which covers this subject in an authoritative and comprehensive manner. The title is, "Maintaining Hygiene in Tetraethyl Lead Operations."

CONCISE, LOGICALLY ORGANIZED and written in a direct, clear style, "Maintaining Hygiene in Tetraethyl Lead Operations" can be extremely helpful to refinery physicians in explaining lead hazards and precautions to refinery personnel.

In spite of the toxicity of tetraethyl lead, an enviable health and safety record has been established by the refinery workers who regularly come in contact with this chemical. The chief aim of the new book is to help the petroleum industry maintain this outstanding record.

Safety As A *Way Of Life*

The theme of the volume suggests that *preventive* medicine — rather than medical care — is the real core of a successful industrial medical program. Its chief emphasis is, therefore, on helping refinery doctors and safety personnel *prevent* accidents resulting from improper or careless handling of tetraethyl lead.

But to prepare the refinery medical staff for *any* emergency related to lead poisoning that may arise, the text also

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OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *Medical Book*

includes specific data on the symptoms and treatment of poisoning from organic lead.

A Useful Reference

"Maintaining Hygiene in Tetraethyl Lead Operations" is a practical reference manual on a highly specialized field of industrial medicine.

Refinery doctors will find it extremely useful, for example, in setting up procedures for examining and advising workers in tetraethyl lead areas.

30 Years Experience

The Du Pont Company has been directly concerned with the manufacture and handling of tetraethyl lead for more than 30 years. It is from this experience – combined with constant, thorough study of the problems involved – that the authors of this book have drawn their material.

In addition to their work with employees in Du Pont's tetraethyl lead manufacturing area, the three authors of the book – Drs. Stewart L. Rankin, Lawrence A. Gerlach and Fenton Russell–have worked closely with refinery medical staffs on safe TEL handling procedures for many years.

THIS NEW Du Pont medical book is printed and bound, for durable use, between hard covers.

Limited Distribution

"Maintaining Hygiene in Tetraethyl Lead Operations" was written expressly for and addressed primarily to doctors in the petroleum industry to whom it will be distributed during the course of the year. A limited number of copies will also be distributed by Du Pont to oil company executives directly concerned with safety and medical procedures in the handling of tetraethyl lead.

Assistant Mid-Continent Regional Manager

DONALD W. FRISON, recently appointed assistant manager of the Petroleum Chemicals Division's Mid-Continent Region, has been with the Du Pont Company since 1947.

His first assignment with the company was as manager of the Mid-Continent District Laboratory. In 1951 he was transferred to the Wilmington office as technical assistant to the director of sales. He later became assistant manager of sales promotion and then assistant to the sales manager.

Before joining Du Pont, Mr. Frison was engaged in CFR engine work and refined petroleum products analysis at the Florida State Petroleum Laboratory. He graduated from the John B. Stetson University in Deland, Florida with a B.S. degree in chemistry.

During World War II, he was a petroleum officer in the U. S. Navy Bureau of Ships and was engaged in tanker loadings at the New York petroleum pool. Mr. Frison is a member of the Society of Automotive Engineers.

New Tank-Cleaning Safety Presentation Available to Refiners

Constant vigilance is *a must* for all personnel engaged in cleaning leaded gasoline storage tanks. But workers easily become bored—and sometimes careless—when safety rules and procedures are presented over and over again in the same old way.

To help overcome this situation, Du Pont has prepared a new, interest-arousing tank cleaning presentation. Our representatives first teach your own training staff how to use this tool—then leave it with you for use as you see fit. It is a penetrating, easy-to-understand training piece that your foremen can use with the tank cleaning crew for "tool box" safety meetings *on the site.*

Turn-Over Style

To make the presentation easy to handle and interesting to present, it has been put together in turn-over style. Copy of the talk and guides for the speaker are printed in large type on the back of each page. Pages facing the audience are illustrated either with colored cartoons or large sized photos of actual operations. All necessary safety precautions and procedures pertaining to the lead hazard are fully covered.

Distribution of the presentation will be limited to those responsible for the safety and training of tank cleaning crews. If you are interested in this important safety aid we suggest you get in touch with the nearest Du Pont Petroleum Chemicals Division regional office at once.

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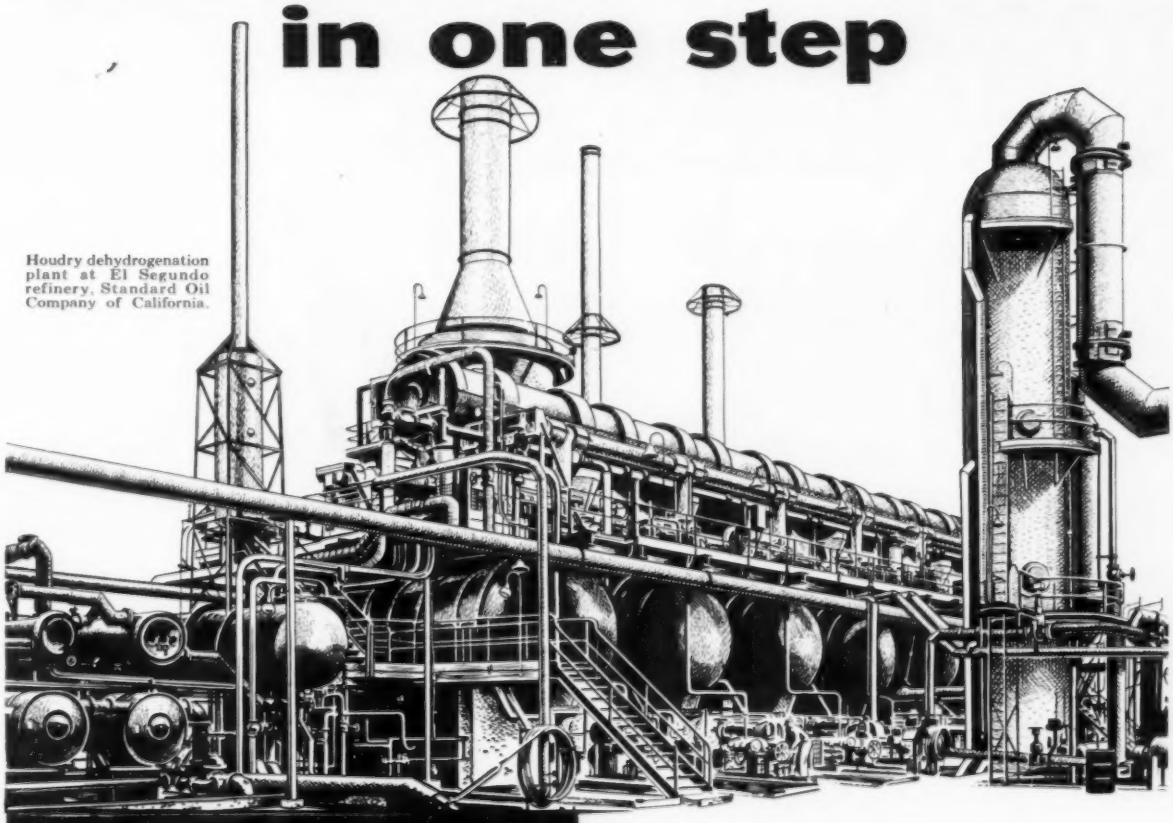

Houdry dehydrogenation plant at El Segundo refinery, Standard Oil Company of California.

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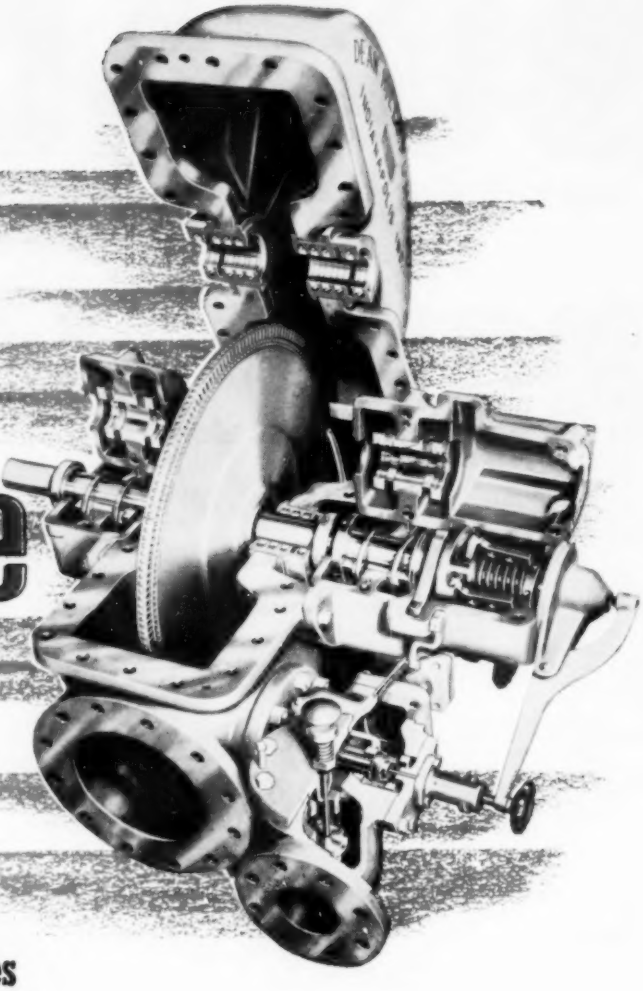
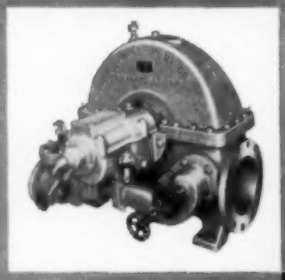


added to DH turbines

More power from the same size unit! Dean Hill presents an improved DH Line of horizontal turbines which produce up to twice the power of former counterparts.



The major change contributing to this tremendous power increase is the addition of one or more steam nozzles to all models, with these results . . .

1. The new, two-nozzle DH-10 and DH-20 turbines have *double* the maximum horsepower of former units.

2. Models DH-30, DH-40 and DH-45, now with three nozzles, are rated 50% higher in maximum horsepower.

FULL INFORMATION AVAILABLE

Many other improvements have been made on the five DH Models, adding to the quality and performance of Dean Hill Horizontal Turbines. A new catalog completely describes these models, and this information will be sent you on request.

Write Today For Dean Hill's New Turbine Catalog No. 500.

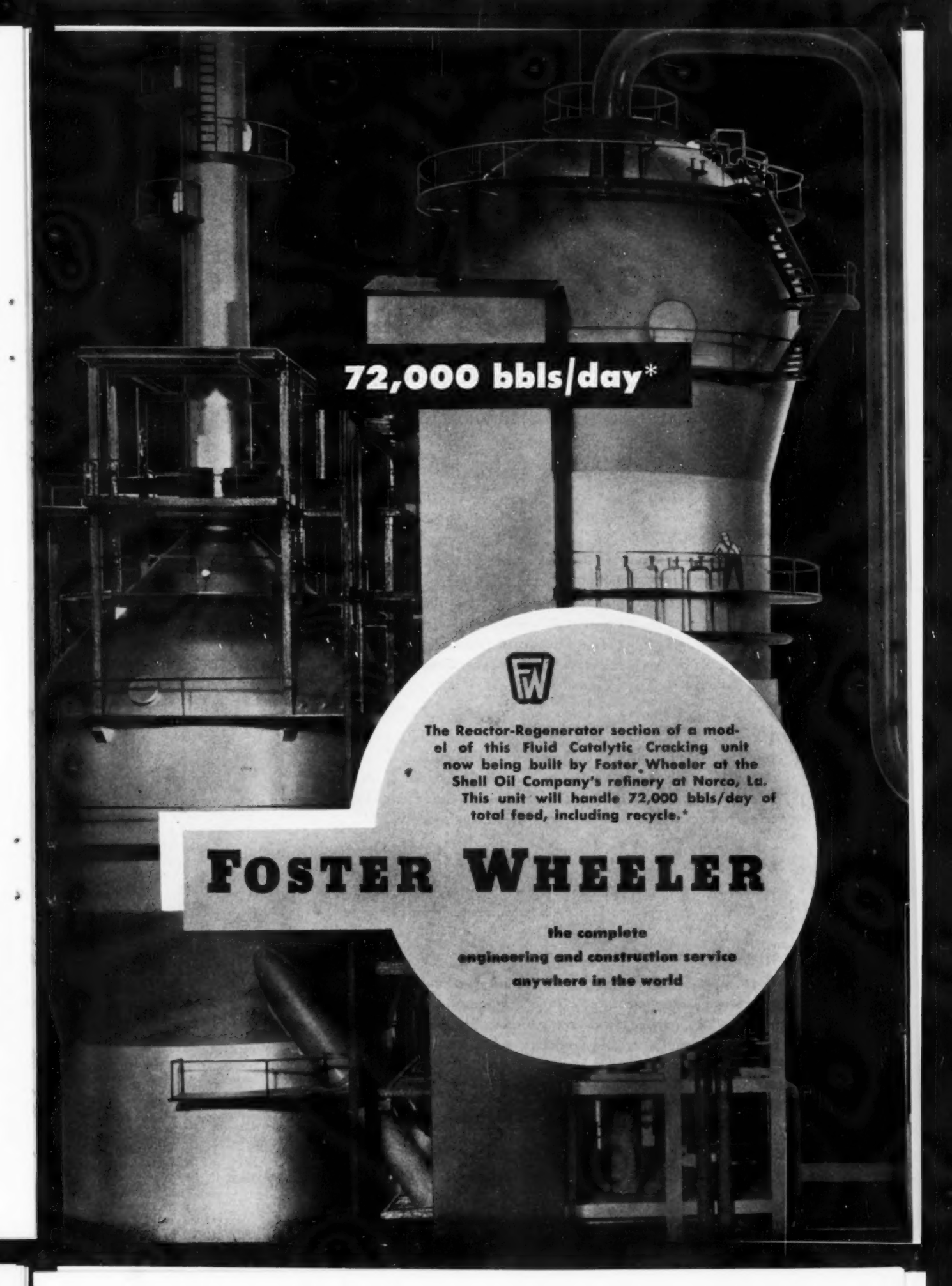
DEAN DH HILL PUMP COMPANY

Pump and Turbine Engineers Since 1893

Indianapolis 7, Indiana

Sales Offices in:

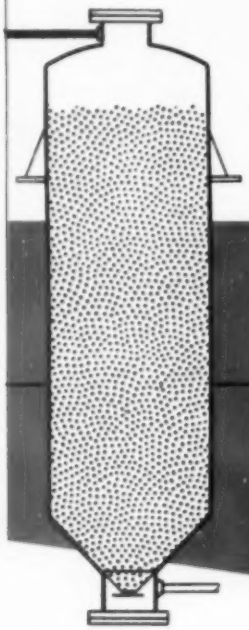
Chicago, New York, San Francisco, Boston, Cincinnati, Denver, Albuquerque, El Paso, Salt Lake City, New Orleans, Philadelphia, Tulsa, Los Angeles, Pittsburgh, Houston, Dallas, St. Paul, Toledo, Cleveland, Grand Rapids, Birmingham, Ala., Louisville, Memphis, Monrovia, Richmond, Roanoke, Cal., Kansas City, Montreal, Pasadena, Pa., The Hague



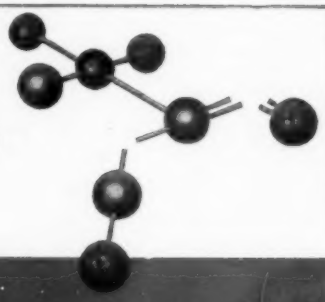
The Reactor-Regenerator section of a model of this Fluid Catalytic Cracking unit now being built by Foster Wheeler at the Shell Oil Company's refinery at Norco, La. This unit will handle 72,000 bbls/day of total feed, including recycle.*

FOSTER WHEELER

the complete
engineering and construction service
anywhere in the world



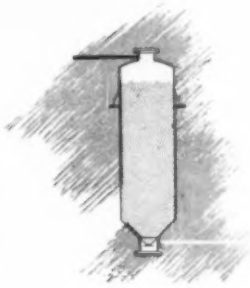
...ready to tackle
any sorptive-mineral job
that comes along...



ATTAPULGUS Fullers Earth
POROCEL Activated Bauxites

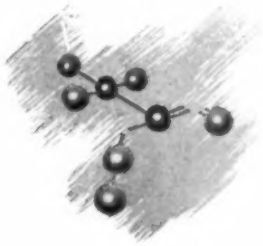
ADSORBENTS

There's an Attapulgus or Porocel adsorbent to fit your process technique for removing odors, colors, tastes, moisture, acids, sulfur, fluorides and unsaturates from process liquids or gases. Materials treated in principal applications are: motor oils and other lubricating, specialty, and technical oils; petrolatums and waxes; aviation and motor gasoline stocks; kerosene; diesel and heating oils; chemicals and petrochemicals.



CATALYSTS, CATALYST CARRIERS

Our sorptive minerals are recognized standards in desulfurization, reforming and isomerization systems—catalytic removal of unsaturates—conversion of sulfides to elemental sulfur—fluid catalyst applications—as catalyst carrier in copper sweetening processes.

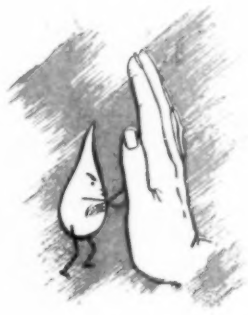


DESICCANTS

We offer a wide range of reliable, thoroughly proved desiccants for drying air, hydrogen, carbon dioxide, hydrocarbon liquids and gases.

SPECIAL GRADES

Mine and plant facilities permit prompt and economical production of grades meeting individual customer specifications. Our laboratories and technical staffs are ready to assist in research, development, design and operating problems. Your inquiries are invited.



ATTAPULGUS MINERALS & CHEMICALS CORPORATION · **POROCEL** CORPORATION

Dept. D, 210 West Washington Square, Philadelphia 5, Pa.

Carpenter **Stainless Tubing...**

doesn't cost ...IT PAYS

... in cost-cutting corrosion resistance, time-saving fabrication, and extended service life.

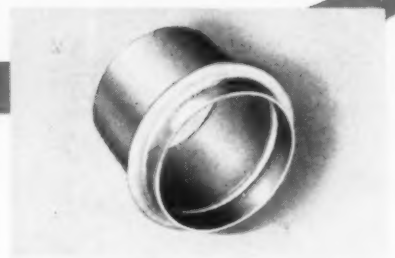
It's this way. There's a difference in stainless tubing quality and uniformity—and Carpenter makes it. Pictured here are three random examples. Hundreds more are on file from process equipment fabricators and chemical plant engineers citing how the difference in Carpenter Stainless Tubing pays off in easier fabrication, lower production and maintenance costs, and more freedom from costly corrosion troubles and equipment "down-time".

In short, you get all-around stainless tubing satisfaction when you give Carpenter Stainless Tubing the job of handling corrosive materials in your plant. You can count on your nearby Carpenter Distributor or Branch Office for prompt service on your requirements and experienced technical help in selecting and fabricating your tubing.

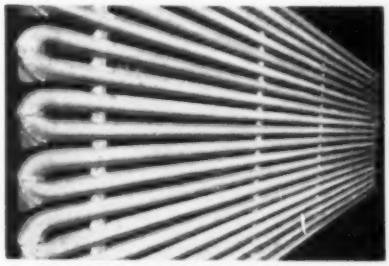
The Carpenter Steel Company, Alloy Tube Division, Union, N. J.

Branch Offices: Atlanta Chicago Pittsburgh Houston Newark San Francisco

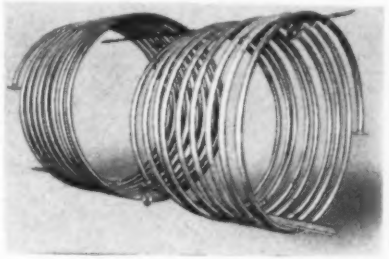
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y. "CARSTEELCO"



FOR EQUIPMENT PARTS—ability of Carpenter Stainless Tubing to "take" severe fabrication due to its uniformity and ductility saved fabricator of this bubble cap 10c a piece and enabled him to get longer production runs.



FOR PROCESSING EQUIPMENT—ten cooling coils like this were made from Carpenter Stainless Tubing at a saving in material of about $1000 because uniform walls permitted using a lighter gauge.



FOR SUPER CORROSION RESISTANCE—coil life in a hydrolysis tank was more than doubled by switching from lead to Carpenter Stainless No. 20.

Carpenter

STAINLESS TUBING & PIPE

Analysis · Tolerance · Finish

• guaranteed on every shipment

WHEN CONTROL VALVES
ARE CONSIDERED . . .

It's Automatically the finest!

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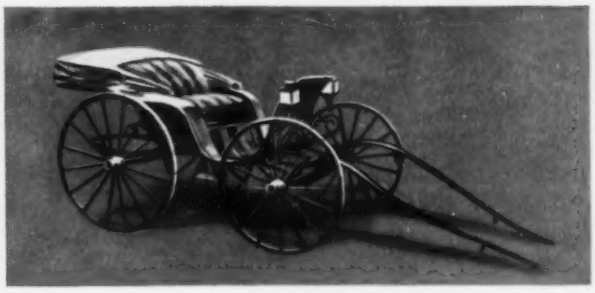
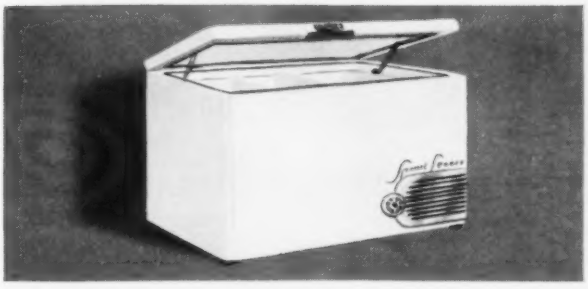
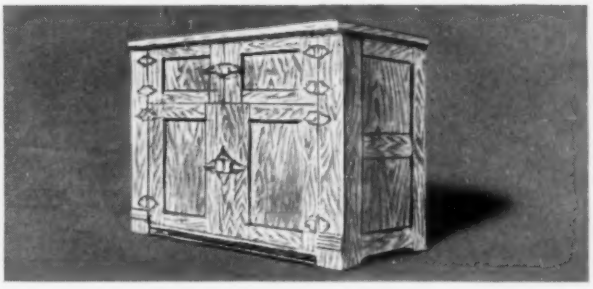
SALES OFFICES IN ALL PRINCIPAL CITIES
MANUFACTURING PLANTS IN WARWICK, R. I., U.S.A., CANADA, ENGLAND, FRANCE AND HOLLAND

With the help of Advertising

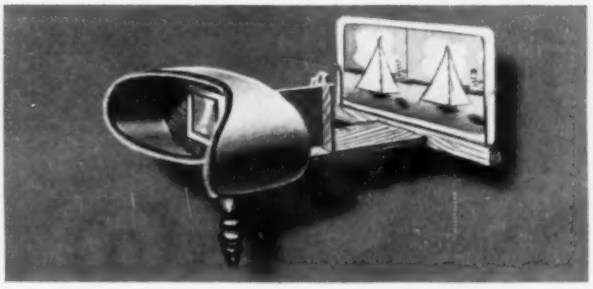


You have this . . . . . *Instead of this*





You have this . . . . . *Instead of this*



You have this . . . . . *Instead of this*

Advertising Benefits Everyone

The credit for the many wonderful products of our "American Way of Life" must be *divided*. The Inventor, the Investor, the Businessman, the Worker—all rightfully share that credit. **BUT** . . . it is *Advertising* that tells the story of the product; it is *Advertising* that whets public appetite for the product; and it is *Advertising* that helps sell the product. **AND** . . . the more product-demand that Advertising builds, the more products must be manufactured. That means Mass-Production which, in turn, means better products at lower prices. In short, a *still higher* American living standard. **SO** . . . *everyone* benefits. Industry, Business, Labor, Agriculture. But, most important of all, YOU the citizen.

And all with the help of Advertising!

ADVERTISING FEDERATION OF AMERICA *and* ADVERTISING ASSOCIATION OF THE WEST • *(Prepared by the Cleveland Advertising Club)*

CUPRO NICKEL, 30%-702

for your toughest heat exchange problems

CUPRO NICKEL, 30%-702, is the best and most widely used copper alloy for tubes in refinery heat exchangers operating under the severest conditions—where corrosive materials and cooling waters must be handled at relatively high temperatures and pressures.

In refinery heat exchanger equipment, tubes of Cupro-Nickel, 30%-702, retain strength at relatively high operating temperatures and are resistant to stress-corrosion cracking. The alloy has the property of forming protective films of corrosion products, making it particularly desirable for service where sea water, even at relatively high velocities, is used for cooling.

Our Technical Department will welcome the opportunity to investigate your heat exchanger tube problem and to draw upon its long experience in tube performance to suggest the most suitable alloy. Feel free to use this service.

Meanwhile, send for your free copy of Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers." *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

53114 Rev.

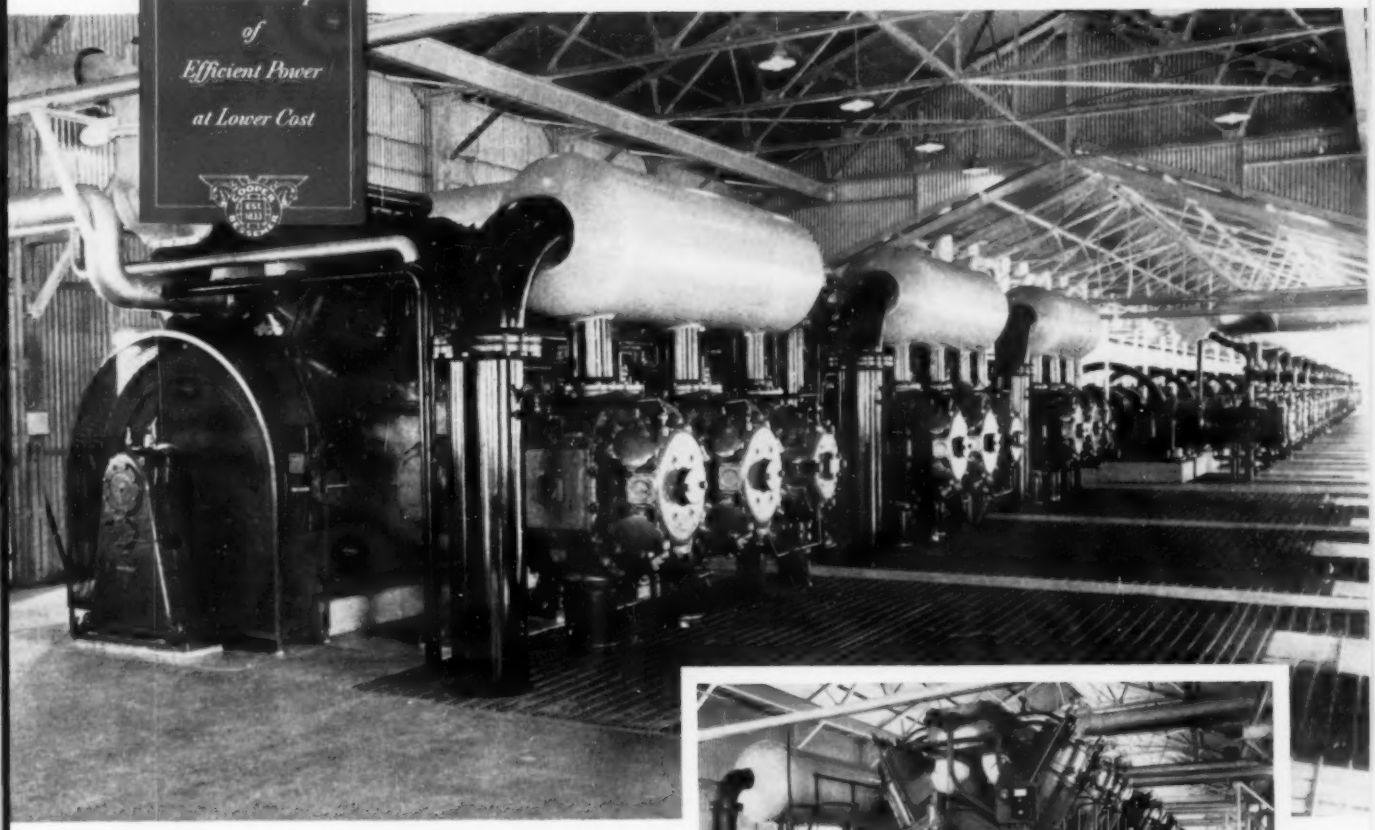
for efficient heat transfer

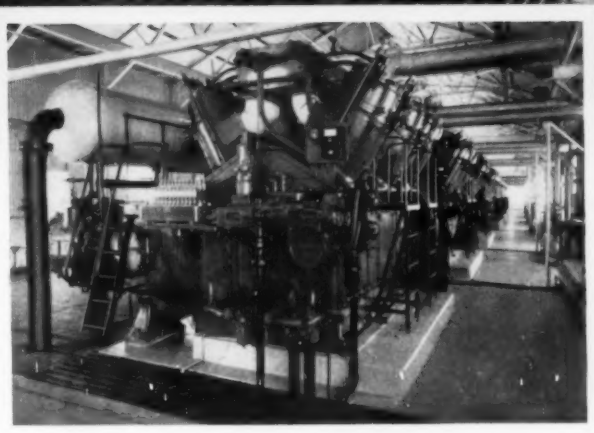
ANACONDA®

HEAT EXCHANGER TUBES

Another Example of Efficient Power at Lower Cost

Below: Line-up of modern, compact 600 hp GMV-6's and old-type 200 hp Cooper-Bessemer horizontals in Skelly Oil Company's Eunice gasoline plant. Old horizontals, originally installed in 1926 at Skelly's Seminole plant, were moved to present location in '49 . . . and have averaged about 98.9% running time.





Right: This line-up of 7 GMV's includes the three 6-cylinder units shown in the large photo, plus 4 very recently added 1350 hp GMV-10's. Modern GMV's in the Eunice plant now total 7200 horsepower.

IN SKELLY NATURAL GASOLINE SERVICE

..a 27-year line-up of C-B compressors

THE compressor line-up in the big photo above includes modern GMV's and 27-year-old horizontals. Today both types, totaling over 10,000 horsepower, are working side by side in Skelly Oil Company's Plant #2 at Eunice, New Mexico.

The photo reveals a significant contrast in space requirements. The old horizontals, 19 of them extending to the vanishing point, produce 200 hp per unit. But the compact new GMV's, actually occupying less space, are rated 600 hp—3 times as much power per unit. And what's more, today's GMV's, unmatched in thermal efficiency, consume less than 7500 B.T.U. per horsepower hour!

Check up on any and all factors . . . compactness, efficiency, service life, installation cost, maintenance, supervision, etc., . . . you'll find Cooper-Bessemer V-angles your best bet for lowest cost compressor service.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

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Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.
Shreveport, La. St. Louis, Mo. Los Angeles, Calif. Gloucester, Mass.
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DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS • HIGH PRESSURE LIQUID PUMPS

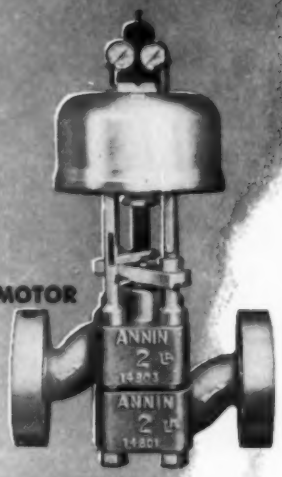
REACHING FOR NEW HIGHS

Annin's Guided Missile Achievements Help Solve YOUR Extreme Pressure Control Problems

Annin's superiority comes from the rugged proving grounds of guided missile work, where simple valve design, rugged construction and dependable operation are the factors that count. From this beginning Annin research and engineering have constantly reached for "new highs" in efficient control of difficult fluids under extreme conditions of pressure and temperature. This experience can now be applied in solving YOUR high pressure problems with these new standard model Annin Domotor, Cylinder and Handwheel operated valves. Pressure and temperature ratings of 6000 psi (standard*) and —325° F to 1200° F. Like all Annin models they offer flexibility in operation, bubble-tight shut-off, reduction in valve inventory and low maintenance cost. Get the facts today on ANNIN's work in the high pressure field, and what this experience can mean to you in savings and service.

*Special valves now in production to 30,000 psi

DOMOTOR



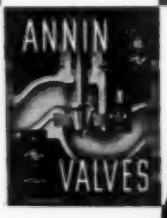
Model 2560, series 90-150, pressures to 3600 psi; temperatures —325° F to 1200° F.
Model 3560, series 250, to 6000 psi.

CYLINDER

Model 2520, series 90-150, pressures to 3600 psi; temperatures —325° F to 1200° F.
Model 3560, series 250 to 6000 psi.

HANDWHEEL

Model 25, series 90-150, pressures to 3600 psi; temperatures from —325° F to 1200° F.
Model 35, series 250, to 6000 psi.



WRITE TODAY
for illustrated Bulletin showing how and why Annin offers the best buy in control valves.

THE ANNIN COMPANY
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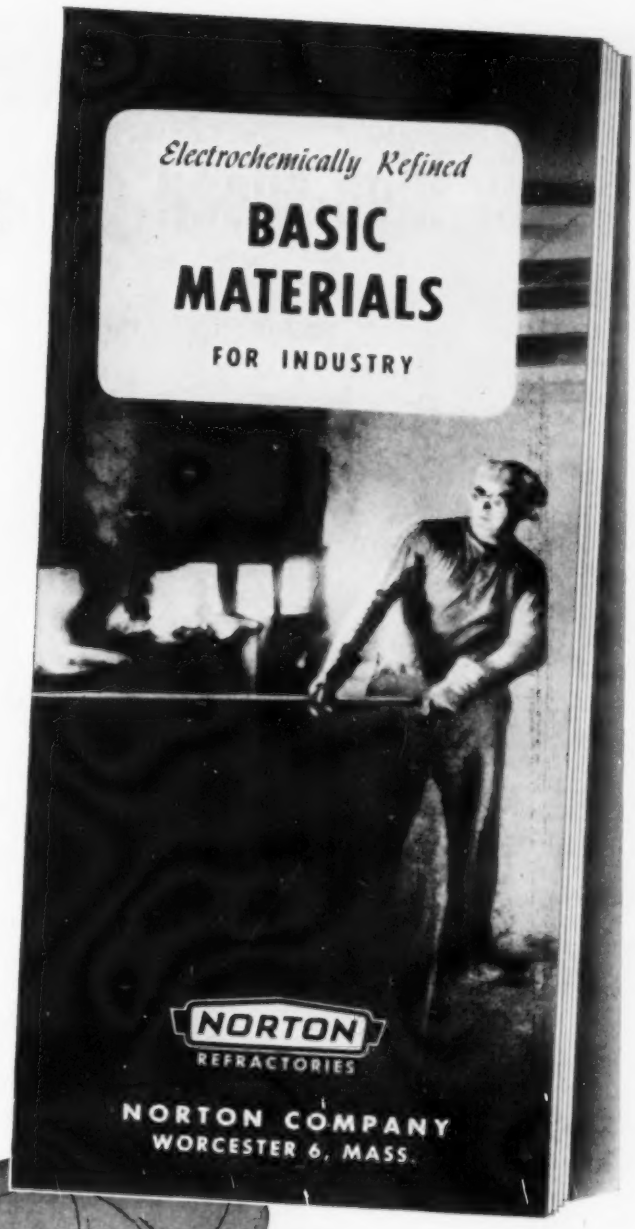
ANNIN *Control* **VALVES**

FREE!

Basic guide book to Norton Rx basic materials



Filled with valuable facts on electric furnace products vital to industry

Here, in one compact booklet, is a complete list of Norton electrochemically refined basic materials for industry. Twenty-two pages of detailed descriptions of compositions and properties, with actual and suggested uses for the following:

ALUNDUM*, CRYSTOLON*, MAGNORITE* and NORBIDE* materials. Also FUSED STABILIZED ZIRCONIA, BORON NITRIDE, SPECIAL FUSED OXIDES, REFRACTORY CARBIDES, REFRACTORY BORIDES, MIXED BORIDES, ELEMENTAL BORON and EXPERIMENTAL BORIDES, CARBIDES, NITRIDES and SILICIDES.

Available in Many Standard or Special Forms

Besides supplying these materials in their crude forms, more or less as they come from the furnace, Norton has extensive facilities for processing and fabricating and is ready to work with you on engineering materials to your particular requirements.

For YOUR Applications

Many of these materials are in regular industrial use. New uses are being found for others, while the rest are still being tested and developed. That's why it will pay you to read about them very carefully. In this booklet you may find exactly the combinations of properties you are looking for. For your copy of "Basic Materials" write to NORTON COMPANY, 261 New Bond St., Worcester 6, Mass.

NORTON

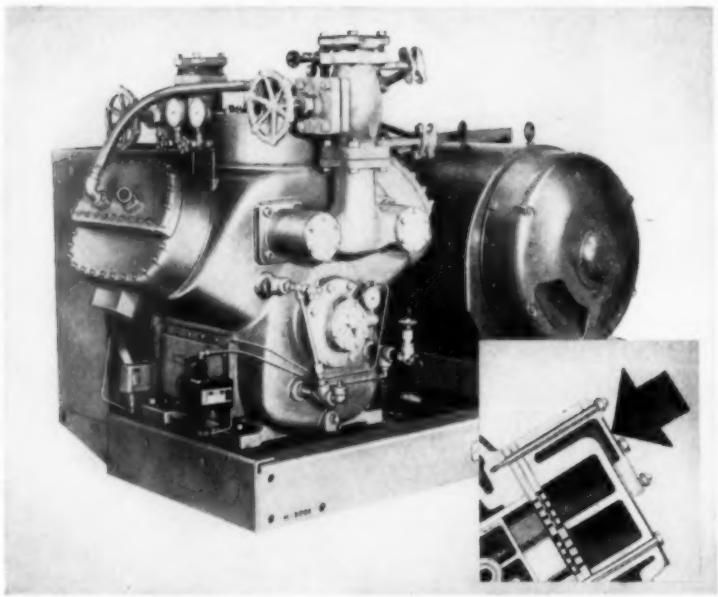
Rx *REFRACTORIES*

Making better products . . . to make other products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

 (To obtain more data on advertised products see page 276)

Look at all the features of Worthington's new high-speed ammonia compressor



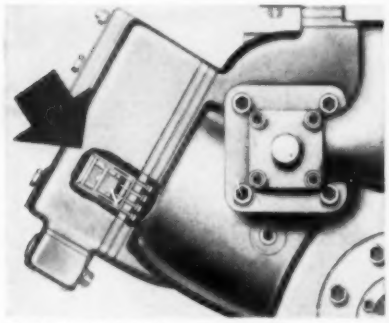
IMPROVED INTERNAL MANIFOLDING—cool suction gas completely surrounds the cylinder walls, providing longer valve life and increased overall efficiency. All passageways between suction discharge and shutoff valves are cast integrally within the crankcase, eliminating outboard fittings. Cross section shows water jacketing on one of the cylinders.

High operating efficiency and lighter weight make this modern unit the talk of the industry

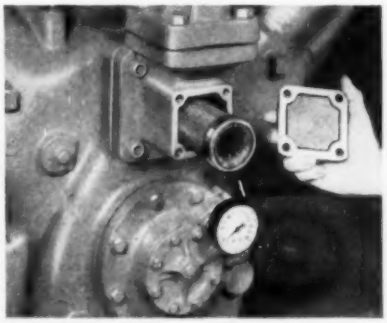
These lightweight, compact Worthington ammonia compressors have the same high operating efficiency and versatility as their lower speed counterparts.

Ranging in capacities from 18 to 150 tons, the new units can be used as high-stage or booster machines.

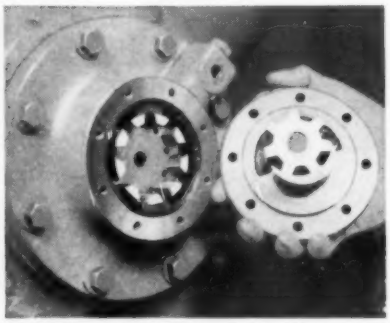
Get in touch with your nearest Worthington district office for more facts about these rugged compressors. Or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.3.56, Holyoke, Mass.



ELECTRIC UNLOADING—a new achievement in variable capacity control. You can start compressor with a normal torque motor; power consumption is automatically balanced against load. Separate unloader units allow easy maintenance . . . no oil or gas pressure lines to worry about.



NEW SUCTION MANIFOLD, with cover plate over suction strainer inlet, allows easy removal of the suction gas strainer for cleaning, without disturbing any of the pipes, valves or other parts. The strainer is unique in that it fits entirely within the crankcase manifold, requiring no additional space.



NEW FORCE-FEED LUBRICATION SYSTEM — full pressure, positive lubrication, regardless of rotation. A new rotary oil pump, driven directly by the crankshaft, eliminates complicated and noisy gear trains. Oil is filtered through a strainer in the crankcase for protection of pump and other moving parts.

A.3.56

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

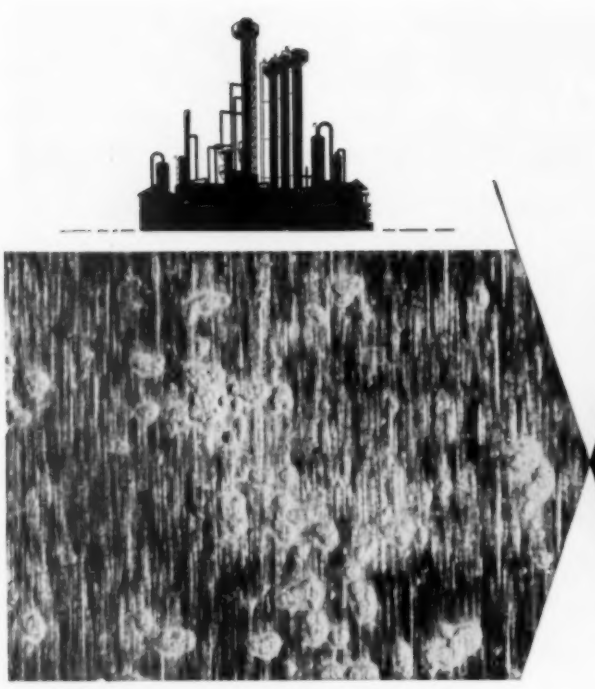
this new book answers:

HOW MUCH CAN YOU SAVE WITH A LJUNGSTROM?

You save up to 20% of your fuel costs alone on process units, for example. The Ljungstrom Air Preheater recaptures waste heat from stack gases and returns it to the furnace, thus reducing the quantity of fuel you need to maintain throughput. *There are three other cash advantages* with Ljungstrom, too. *Throughput increases* up to 25% . . . *octane rating increases* as much as two points . . . *maintenance costs are reduced* because of much lower rate of slag formation on furnace tubes. You'll find confirming details on these great savings – and more – in this book just published by The Air Preheater Corporation. Just ask for Catalog L-3.

WHEREVER YOU BURN FUEL, YOU NEED LJUNGSTROM

The Air Preheater Corporation, 60 East 42nd Street, New York 17, N. Y.



Want Complete Protection Against Water-side Scale and Corrosion?

One of the most difficult problems in corrosion control of cooling water systems is the continuance of pitting and tuberculation. But these troublesome conditions can now be eliminated quickly and effectively with the Betz Dianodic* method of corrosion inhibition.

For example, a midwestern oil refinery with a circulation rate of 40,000 gallons per minute employed "conventional" chromate treatment of the cooling water system. Inspection after 10 months operation showed satisfactory control of scale and general corrosion, but pitting and tuberculation was so serious that it was necessary to "fill-in" the end-around baffles by welding.

After a thorough engineering survey, Betz Engineers recommended the new Dianodic method of cooling water control. Here's what happened: After another 10 months operation, test specimen data showed average penetration values were reduced to 0.001 inch per year. Of greater importance, the maximum depth of the infrequent pits amounted to only 0.02 inch per year. And, the welded baffle ends were in perfect condition with the original welding marks clearly visible!

Betz Service Mark

The Dianodic method, developed by Betz Engineers, is a system of combining two anodic inhibitors in such a way as to *effectively eliminate* pitting and tuberculation and at the same time provide protection against general corrosion and scale. It is just one of the many advanced developments produced by Betz . . . the result of sound engineering and progressive research in water conditioning for over a quarter of a century. We'd be pleased to show you how you can obtain similar results in *your* plant. Write today, there's no obligation of course. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Penna. In Canada: BETZ Laboratories Limited, Montreal 1.

Betz Technical Paper No. 125 gives full details of the Dianodic Method. May we send you a copy?

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

how to SOLVE your LOW-CAPACITY FLOW CONTROL problems

Q. What are Controlled Volume Pumps?

A. Reciprocating, positive displacement, flow control instruments, driven by air or electric motor. They pump with a repetitive accuracy of plus or minus one percent. Capacities from 3 milliliters per hour to 45 gallons per minute ... Pressures to 25,000 pounds per square inch. Capacity adjustment—manual ... or automatic response to a control signal from an electronic or pneumatic control instrument.

Q. Where are Controlled Volume Pumps Used?

A. Across all industry ... for flow control and pumping of precise quantities of chemicals and slurries ... for accurate ratioing of chemical streams ... and for automatic control of a process variable, such as pH, using these pumps as final control elements.

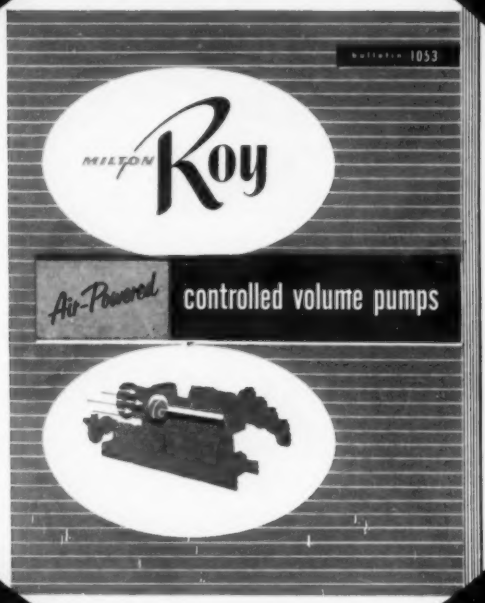
Q. What is the Milton Roy Exclusive Step-Valve Liquid End?

A. A patented step-valve liquid end with individually inspectable ball checks (to facilitate cleaning). Sloping passages purge entrained air, assuring high repetitive volumetric efficiency.

Engineering Representatives in the United States, Canada, Mexico, Europe, Asia, South America and Africa.

This new 16-page Bulletin 1053 on Air-Powered Controlled Volume Pumps is your guide to precise flow rate control of low-capacity chemical and slurry streams. It contains a graphic presentation of pump operating principles; capacity-pressure and air-consumption tables; examples of complete Milton Roy engineered chemical feed systems, using these instruments.

Solve *your* low-capacity flow control problems. Send for your copy of Bulletin 1053, *now*.



CONTROLLED VOLUME PUMPS ARE FLOW CONTROL INSTRUMENTS

MILTON Roy COMPANY

Manufacturing Engineers • 1400 E. MERMAID LANE • PHILA. 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

(To obtain more data on advertised products see page 276)

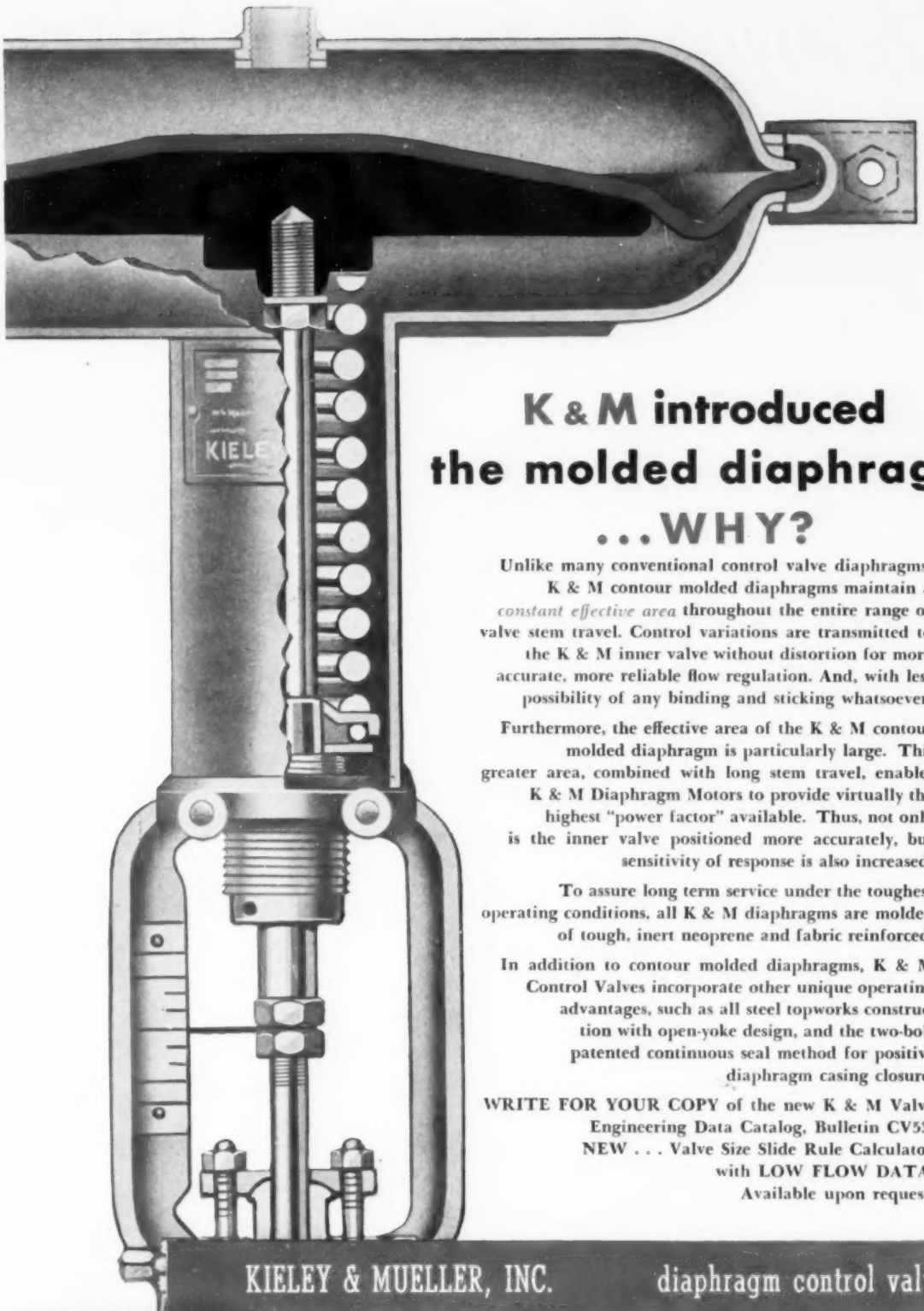
YOUR ASSURANCE OF *FIRST-TIME* AND *EVERY-TIME* DEPENDABILITY FOR FLAMMABLE LIQUID FIRES

JUST OUT—"Foam Fire Protection," illustrated booklet on what Foam is, what it does, how it works. Yours free.

EVERY BATCH of AER-O-FOAM is tested on actual petroleum or polar-solvents fires before it is offered to you. Each phase of the performance is checked—such as extinguishment time, foam volume and sealability.

AER-O-FOAM's tough blanket of tiny air-filled bubbles smothers and cools fire at the same time. What's more, it can be used to insulate surrounding property and equipment against fire damage. Write for data on AER-O-FOAM (for petroleum fires) and AER-O-FOAM "99" (for polar-solvent or petroleum fires). When you need foam fire protection, you need *fire-tested* AER-O-FOAM protection.

NATIONAL
FOAM SYSTEM INCORPORATED
Headquarters for Foam Fire Protection — WEST CHESTER, PA.



K & M introduced the molded diaphragm ...WHY?

Unlike many conventional control valve diaphragms, K & M contour molded diaphragms maintain a *constant effective area* throughout the entire range of valve stem travel. Control variations are transmitted to the K & M inner valve without distortion for more accurate, more reliable flow regulation. And, with less possibility of any binding and sticking whatsoever.

Furthermore, the effective area of the K & M contour molded diaphragm is particularly large. This greater area, combined with long stem travel, enables K & M Diaphragm Motors to provide virtually the highest "power factor" available. Thus, not only is the inner valve positioned more accurately, but sensitivity of response is also increased.

To assure long term service under the toughest operating conditions, all K & M diaphragms are molded of tough, inert neoprene and fabric reinforced.

In addition to contour molded diaphragms, K & M Control Valves incorporate other unique operating advantages, such as all steel topworks construction with open-yoke design, and the two-bolt patented continuous seal method for positive diaphragm casing closure.

WRITE FOR YOUR COPY of the new K & M Valve Engineering Data Catalog, Bulletin CV53.
NEW . . . Valve Size Slide Rule Calculator with LOW FLOW DATA.
Available upon request.

KIELEY & MUELLER, INC. diaphragm control valves

K&M

64 Genung Street
Middletown, New York

Valve Makers
Since 1879

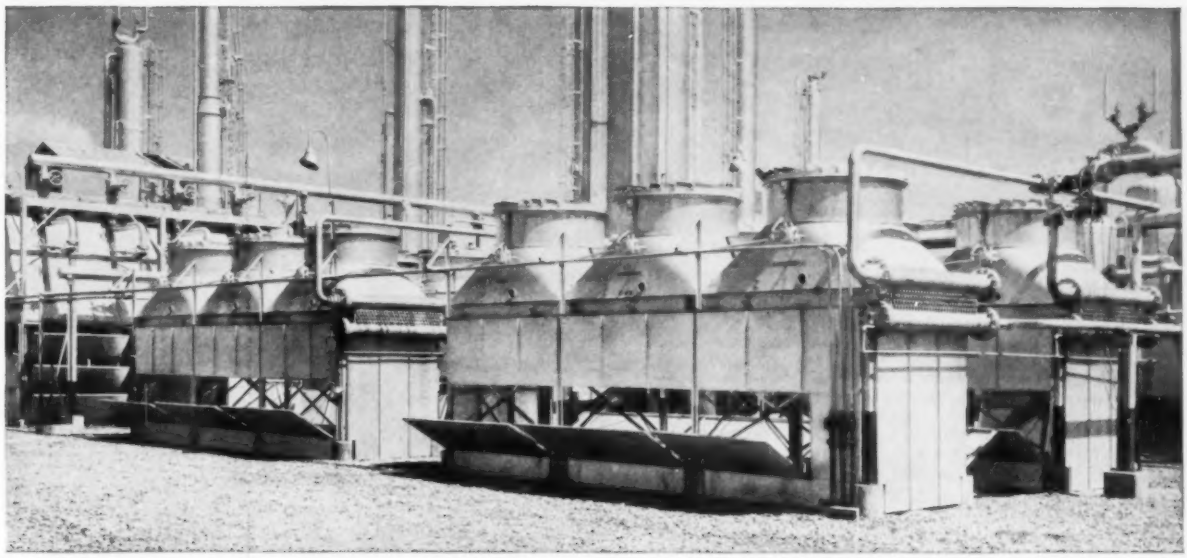
 (To obtain more data on advertised products see page 276)

Profit-building answers to Modern

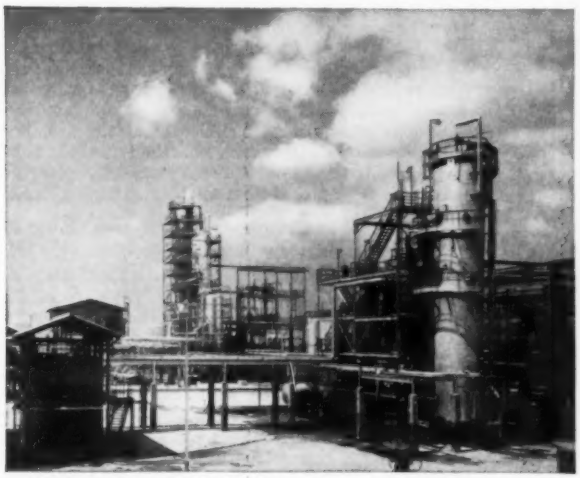
...examples of the wide variety of heavy-metal equipment designed and built by Alco to meet today's demands in petroleum and petrochemical processing . . . results of **Alco Experience** . . . gained through many years of designing and building heavy-metal equipment for refining and processing companies the world over . . . and **Alco Facilities** . . . capable of handling economically an extremely wide range of metal-fabricating operations . . . of meeting strictest customer specifications.

NEW 25 SPINDLE DRILLING MACHINE at Alco's Dunkirk plant typifies the special equipment that enables Alco to produce profit-building answers to almost any processing problem. Spindles take drills up to 1-in. in diameter, pierce steel tube-sheets and support plates up to 4-in. thick at optimum speed.

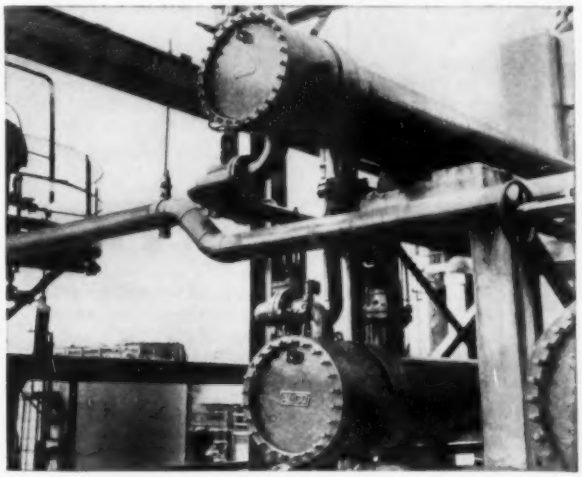
Processing problems



AIRCOOLERS solve the problem of efficient, economical heat dissipation in arid regions. Here, at a Wyoming gas plant, each of two batteries of two specially designed Alco units cools 125,500 lb per hr of lean solution (175 psi, 200 F) at a rate of 4,920,000 Btu per hr—a total of 251,000 lb and 9,840,000 Btu per hr.



AMONG THE MANY ALCO UNITS now in service at Shell Caribbean Petroleum Company's new refinery at Cardon, Venezuela, are the pressed oil flashtower and pressed oil stripper. With a daily capacity of 170,000 bbl, Cardon is the largest refinery on the South American continent.



SPECIAL MONEL CONDENSERS, fabricated by Alco for Atlantic Refining Company's Philadelphia plant, boost efficiency in the manufacture of "Ultrawet" synthetic detergent. Monel construction guards against corrosion by the dilute hydrochloric acid produced in the vapors.

As the first step toward profit-building answers to your own processing problems, contact your nearest Alco Products Sales Representative today. Offices in Dunkirk, New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa, and Beaumont.

ALCO

ALCO PRODUCTS DIVISION

AMERICAN LOCOMOTIVE COMPANY • DUNKIRK, N. Y.

HERE ARE SOME

Questions and Answers

ABOUT DEHYDRATING NATURAL GAS WITH ALCOA ACTIVATED* ALUMINA

Some of your most frequently asked questions concerning the dehydration of natural gas are answered here. For additional information on other specific drying problems, write to ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 716-B Alcoa Building, Pittsburgh 19, Pennsylvania.

Q. What are the recommended *minimum* and *maximum* velocities through beds of Activated Alumina?

A. There is no *minimum* velocity for best operation through a bed of Activated Alumina. As gas velocity approaches zero, sorptive capacity will approach the *maximum* under static conditions. The rough figure for maximum velocity, based on field experience is 40 ft./min. at about 1000 psi. At pressures approaching 3000 psi., this maximum velocity should be reduced to the order of 20 ft./min.

Q. What is the lowest vapor content that can be obtained safely and consistently with Activated Alumina?

A. Dew points as low as -100° F have been attained using F-type Activated Alumina. Under high pressure operation, dew points in the range of -30° to -40° F are most common and are usually sufficient to do the job.

Q. How do you determine when the Activated Alumina should be dried?

A. In a vertical dehydration tower, the adsorption front will move through the bed as in ion-exchange type reactors. When the water reaches the exit end of the bed, a 'break-point' occurs and the exit dew point of the gas begins to rise. Sometime during this rise, depending on the dryness of gas required, reactivation of the bed should be started. In the field, it is often desirable to set up definite times for reactivation without determining this exit dew point from the bed.

Q. How thick should the beds of Activated Alumina be? What is the best way to retain the Activated Alumina in a vessel?

A. The thickness of the beds is determined by the required time of operation after the cross-sectional area has been decided upon. Many vertical units have been built with a bed depth of three to four times the tower diameter, although this is by no means critical. The Activated Alumina can be retained in the tower by a heavy bar-type screen to support the weight, in conjunction with a finer screen, small enough to retain the individual particles. Balled Tabular Alumina forms a very effective bed support. Two sizes of these balls, the smaller on top of the larger, have been used very effectively as a bed support, giving a relatively small pressure drop and eliminating any screen blinding.

Q. What is the minimum contact time between the gas and Activated Alumina?

A. The contact time between the gas and the Activated Alumina depends on the amount of dryness required. It can be as small as one second in shallow beds where extreme dryness is not required. In many vertical dehydrators, the contact time may be as long as 50-60 seconds.

Q. How do you determine the size of unit to use for a given volume of gas?

A. The size of unit can be determined by fixing a value for linear velocity through the bed, and thus, from the total volume of gas to be dried, determine the cross-sectional area of the bed. Temperature and pressure conditions of the gas will determine the total amount of water which must be removed. Capacity figures for the desiccant at the proposed conditions of the operation will then give the total amount of desiccant required. Length of bed can easily be calculated, knowing the volume and cross-sectional area.

Q. At what temperatures is the Activated Alumina most efficient in removing water vapor from the gas? Through what temperature range can the Activated Alumina be used safely?

A. Activated Alumina and all other desiccants will perform most efficiently at lower temperatures. At temperatures as high as 140° F, the sorptive capacity will be several per cent lower than at 80° F. We have found in recent laboratory tests that all desiccants are adversely affected by the same percentage when raising the temperature from 86° F to 122° F. However, Activated Alumina will remove some water from saturated gas as high as 200° F.

* Registered Trademark

ALCOA CHEMICALS

ALUMINUM COMPANY OF AMERICA

No Seat Leakage Through This Valve ...on Hot Wax Service, for instance

THE INSTALLATION

In the wax unit of a leading Gulf Coast lube oil plant, with Crane Steel Gate Valves in hot wax lines to slabbing machines.

VALVE SERVICE RATINGS

SUITABILITY:	Best for the job
FEATURES:	Outstanding Exelloy trim
MAINTENANCE COST:	Routine care only
SERVICE LIFE:	Good as new—after more than 2 yrs.
OPERATING RESULT:	No production lost to valve trouble
AVAILABILITY:	Regular Catalog item—No. 47X

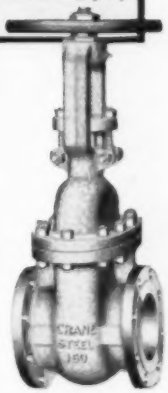
THE CASE HISTORY

The steel valves originally installed here were hindering maximum wax production. The chilling cycle was slow—rejects for remelting were high. The trouble was that the shutoff valves were leaking, and hot wax was getting into the presses during the chilling cycle. Yet the valves were comparatively new.

There's been no such trouble since Crane No. 47X, 150-Pound Gates were installed more than 2 years ago. Their Crane Exelloy trim, suited for temperatures up to 1000 deg. F. keeps giving a tight shutoff on the hot wax, month after month, with easy operation. And they've done so with but routine attention, ever since installed. Better quality is always the bigger value, as every thrifty valve buyer knows.

THE VALVE

Workhorse of the petroleum industry—Crane 150-Pound Steel Gates—with exceptional performance assured by Crane quality design—Crane pioneering in steel casting—and the high adaptability of Crane Exelloy trim for most petroleum services. Sizes 2 to 24 in.; screwed, flanged, welding ends. See your Crane Catalog or your Crane Representative.

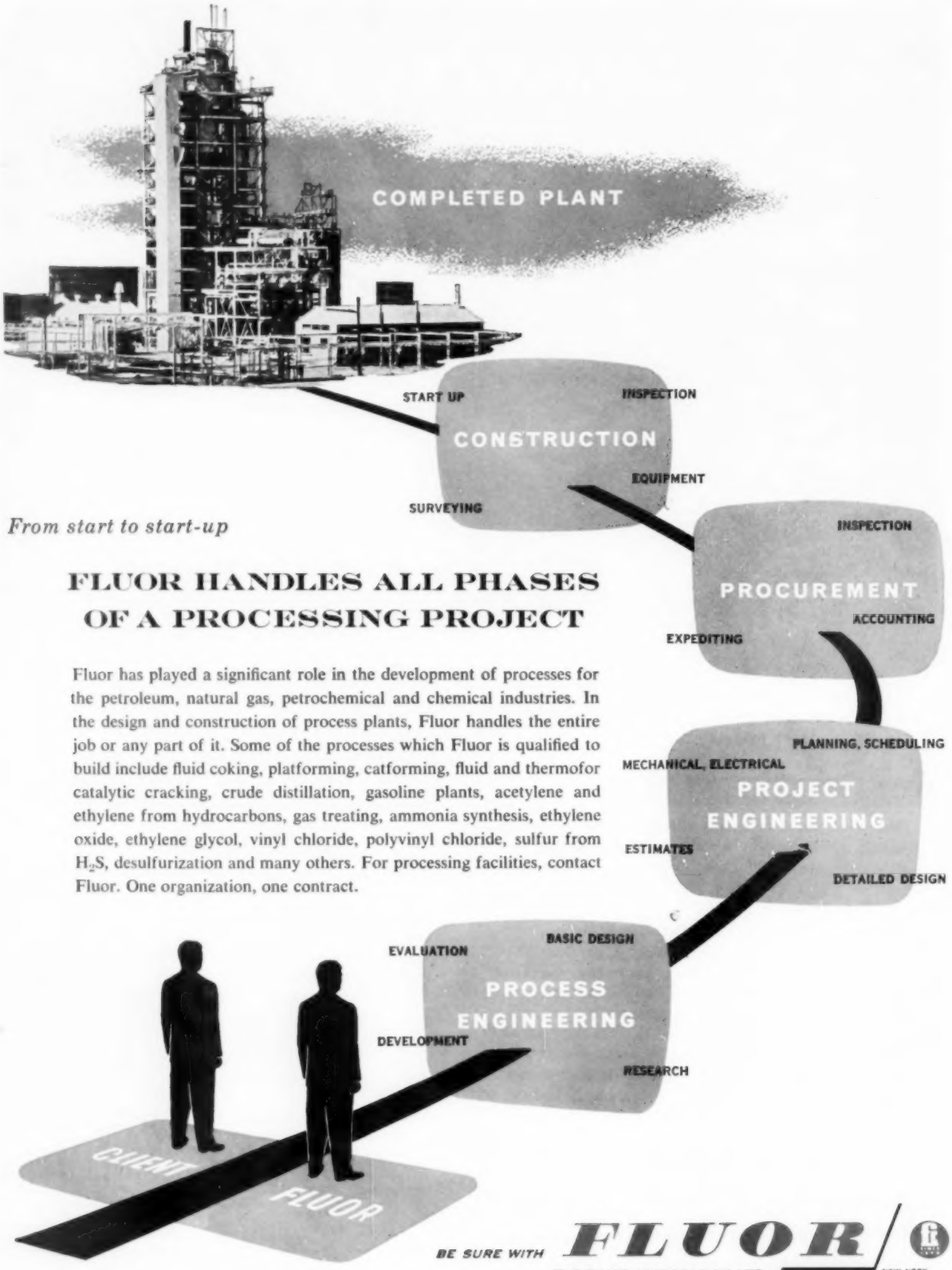


THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



From start to start-up

FLUOR HANDLES ALL PHASES OF A PROCESSING PROJECT

Fluor has played a significant role in the development of processes for the petroleum, natural gas, petrochemical and chemical industries. In the design and construction of process plants, Fluor handles the entire job or any part of it. Some of the processes which Fluor is qualified to build include fluid coking, platforming, catforming, fluid and thermofor catalytic cracking, crude distillation, gasoline plants, acetylene and ethylene from hydrocarbons, gas treating, ammonia synthesis, ethylene oxide, ethylene glycol, vinyl chloride, polyvinyl chloride, sulfur from H_2S, desulfurization and many others. For processing facilities, contact Fluor. One organization, one contract.

BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD.
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FOREIGN FACTS—FLUOR • PARIS
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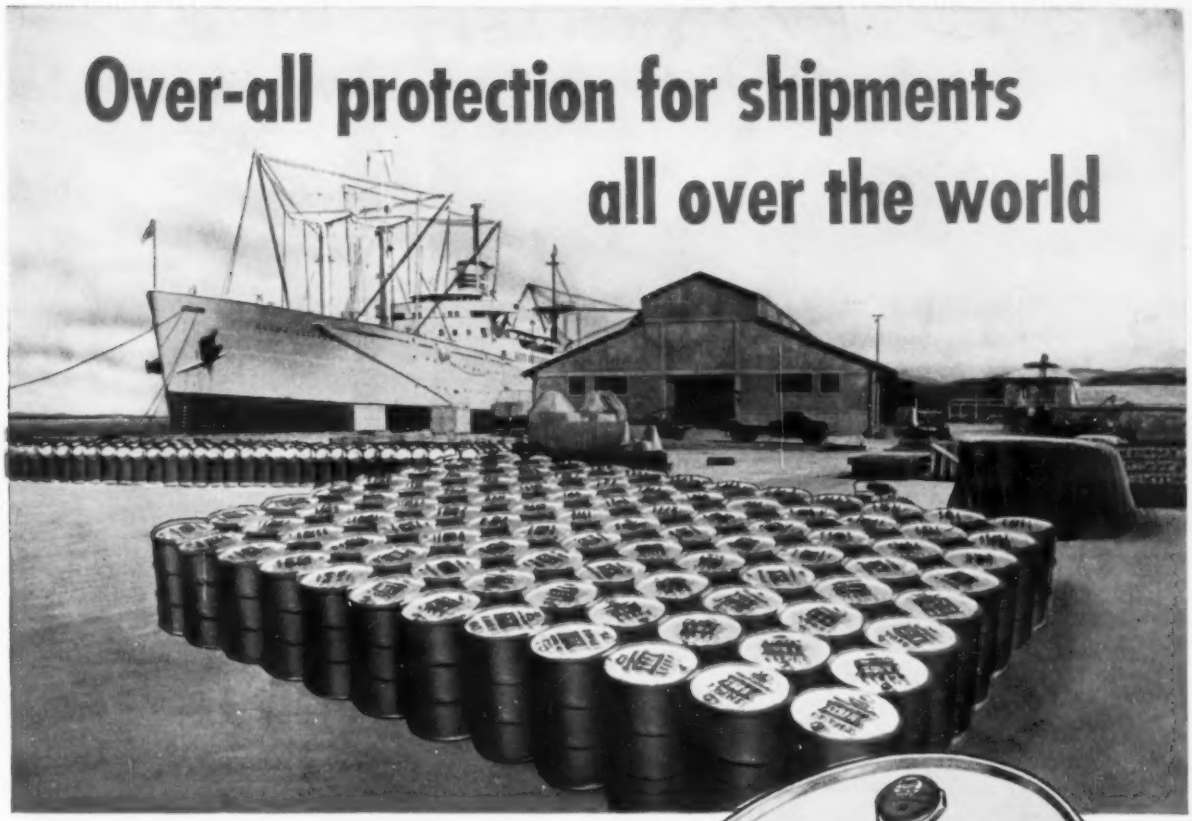
Over-all protection for shipments all over the world



ASIATIC PETROLEUM
guards every drum with

Tri-Sure
Reg. U. S. Pat. Off.
CLOSURES

Shell X-100 Motor Oil and many other brands of lubricants, in hundreds of different grades, are shipped by the Asiatic Petroleum Corporation to ports all over the free world—and it is essential that the perfect uniformity of each product be preserved overseas, whether it is shipped to the tropics, to arctic regions or through several climatic changes.

Asiatic Petroleum Corporation solves the problem by equipping every drum with *Tri-Sure* Closures*. The Tri-Sure Seal, Plug and Flange maintain their leak-proof feature—prevent losses from contamination and evaporation—even when subjected to the severest temperature changes.

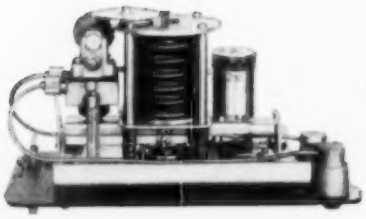
Whether you are a large or small user of drums, it will pay you—in the prevention of losses and saving of gallonage in every shipment—to use Tri-Sure Closures. When you purchase drums, always specify "Tri-Sure Closures" on the order.

*The "Tri-Sure" Trademark is a mark of reliability backed by over 30 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Tri-Sure Products Limited, St. Catharines, Ontario, Canada

TRANSAIRE® to TRI-ACT® to TRANSET®



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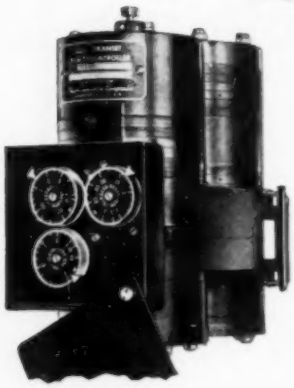

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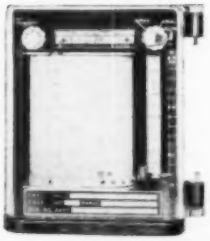
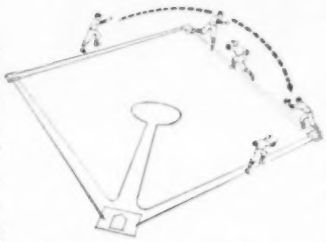


C

YOU DON'T HAVE TO WORRY ABOUT THIS TEAM EITHER!

YOU don't have to worry about the performance of the Taylor TRANSET System. And equally important, you don't have to worry about its maintenance, thanks to the exclusive TRANSET Plug-in feature and complete interchangeability of all receivers and controllers. Pull one instrument out—plug in another in seconds. It's that simple. Think what this means in terms of efficient, economical plant maintenance. Down time—and process interruption—is kept to the absolute minimum. Your instrument men can use their talents to maximum effect—and keep out of the operator's hair—because instruments can be taken to the shop for maintenance. And trouble, whether instrument or process, can be pin-pointed in the shortest possible time by simply plugging in a replacement unit of known performance.



The famous combination of Tinker to Evers to Chance could be relied upon for perfectly coordinated team work. The Taylor TRANSET System comprises three stars of the instrument world that work together to make the fastest, most dependable pneumatic transmission system.

Complete interchangeability of units is achieved by standardizing the output pressure range (3-15 psi) of transmitters, controllers and receivers. This means any controller and any receiver can be used with any (3-15 psi) transmitter. It also means a minimum stock of components.

The Taylor TRANSET System is truly the most versatile control system available today. Your Taylor Field Engineer will tell you how you can benefit from its features, or a post card will bring you **BULLETIN 98097.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

CHECK THESE ADVANTAGES:

1. You can plug in shop-adjusted instruments.

2. You can efficiently analyze process difficulties by quickly substituting a recorder for an indicator.

3. You can switch from the simplest to most complete controller in a matter of seconds.

4. Down time is kept to a minimum, since both controllers and receivers plug in.

5. Maintenance is unnecessary in the area of the panel. Checking can be done in the shop where full facilities are available.

6. One standard panel cut-out ($5\frac{1}{32}$" x $4\frac{5}{32}$") accommodates 12 different forms of recording and 11 different forms of indicating receivers.

7. You conserve panel space without impairing maintenance facilities.

8. Self-purging case for all receivers is especially appreciated in corrosive or dusty atmospheres.

9. Your plant can be kept running smoothly, without expensive shutdowns.

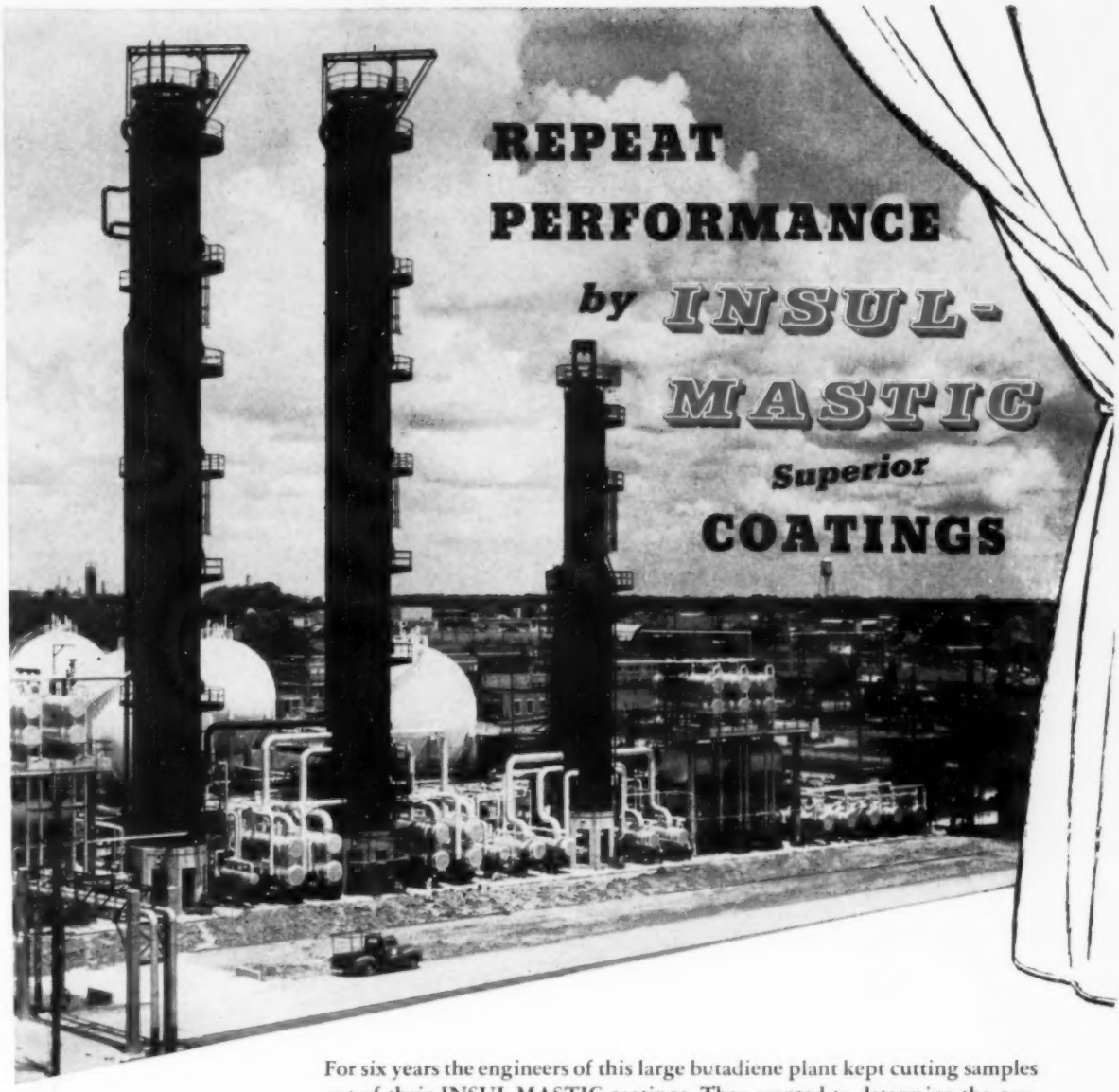
A. TRANSAIRE force-balance temperature or pressure transmitter. SPEED-ACT® gives rate action in the measuring circuit to compensate for process lags. Narrow range spans. Standard 3 to 15 psi output. Interchangeable unit construction. Temperature and Barometric Pressure Compensations.

B. TRI-ACT Controller. A force-balance controller with a new circuit . . . a new concept in process control. Booster relay air valve for faster response of control circuit. Wider response adjustments than ever before. Panel or locally mounted.

C. TRANSET Recorder. Fits 5 1/32" x 4 5/32" opening — a natural for graphic panels; a great space saver for conventional panels. Powerful actuation—bellows operated rectalinear movement. 30-day chart, 3-hour visible record. Everything needed for remote control.

®Reg. U. S. Pat. Off.

Taylor Instruments **MEAN ACCURACY FIRST**



For six years the engineers of this large butadiene plant kept cutting samples out of their INSUL-MASTIC coatings. They wanted to determine the condition of the metal or insulation underneath. What they found was so satisfactory that INSUL-MASTIC was specified when the three new towers above were built. It takes excellent results to command a repeat performance from such critics.

Protect your vessels, Vaporseal your insulation with INSUL-MASTIC coatings. For many long years they will halt weather, acids, alkalis, moisture vapor and other causes of corrosion.

What INSUL-MASTIC has done in the plant above has been repeated in hundreds of plants. Specify *proven* protection. Specify INSUL-MASTIC *Superior* coatings.

Use INSUL-MASTIC Type "D" for insulation and corrosion up to 250 F. Our technical engineers are available to help you with this and other coating specifications.

Think *first* of the coatings that *last!*

Insul-Mastic

CORPORATION OF AMERICA

Oliver Building • Pittsburgh 22, Pa.

Representatives in Principal Cities

Latest type high conversion UOP Fluid Catalytic Cracking Unit installed at the Denver refinery of The Bay Petroleum Corporation.

MODERNIZATION PROGRAM AT BAY DENVER NEARLY DOUBLES CRUDE CAPACITY

By C. O. Garbrecht, Vice President
The Bay Petroleum Corporation

A sweeping modernization and expansion program completed at a cost of several million dollars at our Denver refinery has enabled it to nearly double its crude capacity while at the same time substantially increasing the overall yield of refined products and greatly improving the quality of those products.

C. O. Garbrecht

Our program, which made the refinery at Denver one of the largest in the Rocky Mountain region, was centered around the installation of the latest type high conversion Fluid Catalytic Cracking unit designed by Universal Oil Products Company. The unit has a design capacity of 3,528 barrels per day of fresh feed stock at 76 per cent conversion. The design coke burning capacity is 3,770 pounds per hour.

Coincidental with construction of the cat cracker the Dubbs thermal cracking unit was converted into a visbreaker-vacuum unit for preparation of cat cracker feed stock. A crude topping unit, gas concentration plant, and a polymerization unit also were redesigned, enabling us to make the maximum use of existing refinery equipment.

Universal Oil Products Company designed and engineered the new cat cracker and redesigned existing equipment, while all construction work was handled by Procon Incorporated.

Crude Capacity 11,000 Bbls.

Through these changes, our refinery at Denver which previously processed 6,000 barrels of crude oil daily now handles 11,000 barrels daily, and it is marketing a premium gasoline which is specifically tailored to meet the requirements of high altitude driving.

In our modernized refinery operation, the converted crude unit processes a blend of Wilson Creek, Wellington, and Lance Creek crude oils. A light straight run gasoline, naphtha, kerosene, Diesel fuel, gas oil and reduced crude are prepared from this blend. The latter material forms the charge to the visbreaker-vacuum unit.

Charge to the visbreaker is cracked lightly on a once-through basis before being discharged into a flash chamber. Vapors which are formed there are fractionated into a gas and gasoline overhead and gas oil bottoms. The gas and gasoline are sent to the cat cracker gas concentration unit for further separation and recovery.

After being heat exchanged against crude and then cooled, gas oil bottoms are sent to storage, where they are picked up along with other gas oil streams. The mixture comprises the feed stock for the cat cracking unit.

Bottoms from the visbreaker flash chamber are vacuum flashed in another tower. Vacuum gas oil is condensed and sent to storage as part of the cat cracker charge stock, while visbroken and vacuum flashed pitch is cut back with cat cracker cycle oil to meet No. 6 fuel oil specifications.

Gas and gasoline produced in the cat cracker undergo further processing in the gas concentration plant, which prepares feed for the revamped poly plant, as well as debutanized gasoline. Excess light gases are vented to the refinery fuel system.

Recoveries Run High.

Recoveries of light end materials from the gas concentration system have been found to be exceptionally high, averaging more than 85 per cent on the propane-propylene fraction and nearly 100 per cent on the butane-butylenes.

The gas concentration unit is divided into four sections—a primary absorber, a secondary absorber, a stripper and a debutanizer. Low pressure gas from the cat cracker receiver is supplied to the primary absorber. Condensate in the cat cracker receiver is the absorption medium for this column.

Gas from the primary absorber is sent to the secondary absorber, whose absorption medium is cycle oil from the cat cracker fractionator. Primary absorber bottoms are stripped before being debutanized. Debutanizer overhead is charged to the revamped poly plant, while debutanizer bottoms are sent to cat cracked gasoline storage.

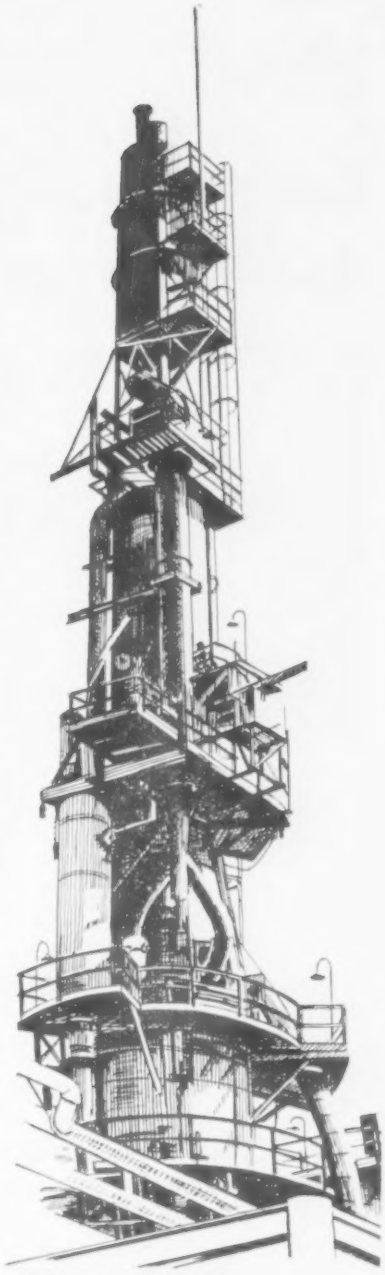
Idle Equipment Used.

Effluent from the poly plant is used as part of the unit's recycle. Because additional heat exchange was needed due to the increase in crude capacity, finned tube sections removed from idle units in the refinery were added to the poly plant.

The poly plant's effluent is depropanized. The net overhead is charged to a de-ethanizer, where LPG is prepared as a bottoms cut.

Depropanized polymer is stripped and excess butane is removed overhead. A 10-pound polymer is produced as a bottoms fraction.

We feel that the constantly increasing demand for our new cat cracked products more than justifies the expenditures we made in modernizing this refinery and making it the finest in Rocky Mountain Area.



New UOP Fluid Cat Cracker for Bay Denver

designed, engineered and licensed by

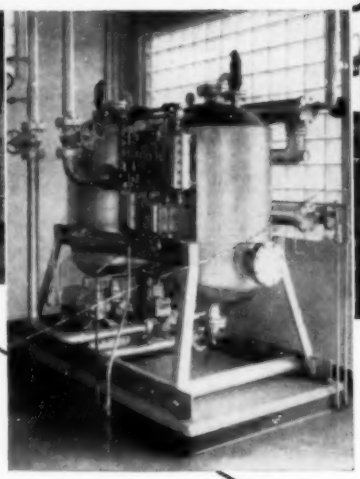
UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD,
DES PLAINES, ILL., U. S. A.
Laboratories: RIVERSIDE, ILLINOIS

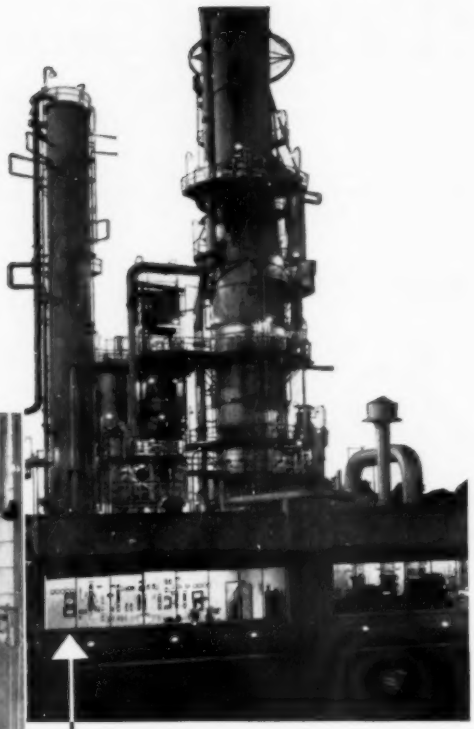
Universal Service Protects Your Investment

 (To obtain more data on advertised products see page 276)

Lectrodryer* feeds the nerve center DRY AIR only!



Type BY-5 Lectrodryer provides continuous flow of dried air to panels in control room, protecting vital control instruments and lines against moisture. →



Automatically controlled McMurrey Refinery near Tyler, Texas. One operator in the control room can control and watch over its entire operation.

2300 instruments . . . 900 controllers and valves depend on DRY air to put this giant through its paces automatically. If unwanted moisture were to creep into instrument air at the nerve center, the refinery could be thrown haywire! An instrument line freeze-up, rust, scale or sludge clogging tiny ports could cause a long shutdown.

For 24 hours a day a Lectrodryer feeds the nerve center a constant stream of air dried to a dewpoint of -50° F. Moisture doesn't have a chance!

Lectrodryers catch the moisture which separators and filters let by. Throughout the chemical and petroleum industries they dry air, gases and organic liquids . . . automatically, economically, continuously. For extreme dryness there are Lectrodryers drying down to 3 to 4 parts per million or less.

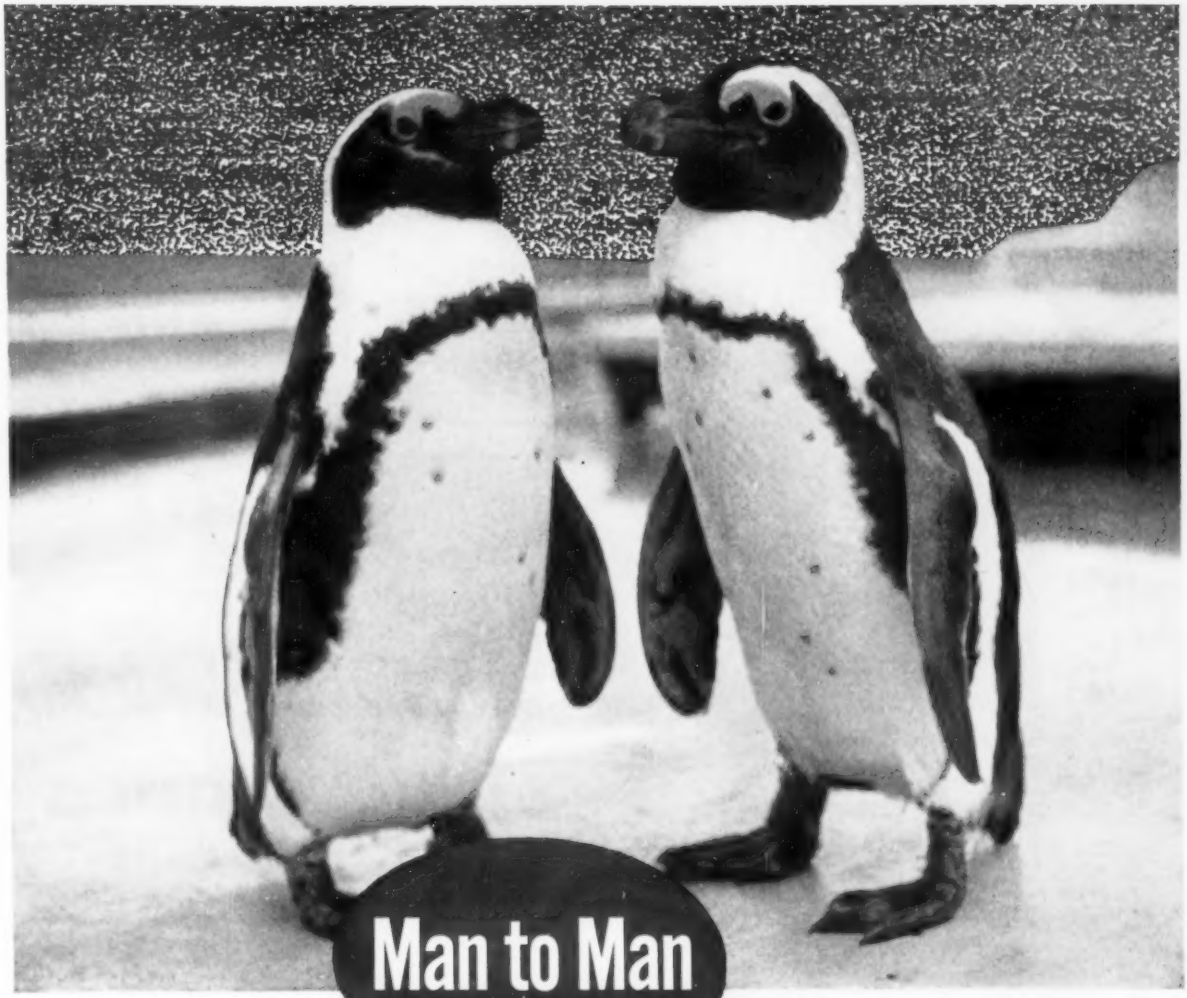
Whatever the drying need, there's probably a Lectrodryer already built to handle it. Our engineers will help you lay out your system and select proper equipment. Write: Pittsburgh Lectrodryer Corporation, 332 32nd Street, Pittsburgh 30, Pa.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

*REGISTERED TRADEMARK U.S. PAT. OFF.



Man to Man

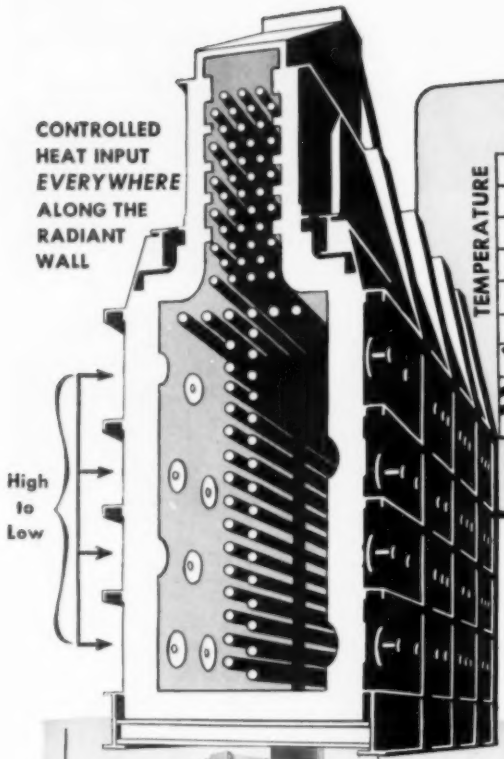
. . . and as engineer to engineer, there's no secret behind the satisfaction that operators of power and processing plants get from Mitchell piping. It is simply our experience—half a century of it, including our pioneering in the forming and welding of 2¼% chromium—1% molybdenum steel and *stainless*. As headache preventative, send your drawings to us for estimate.

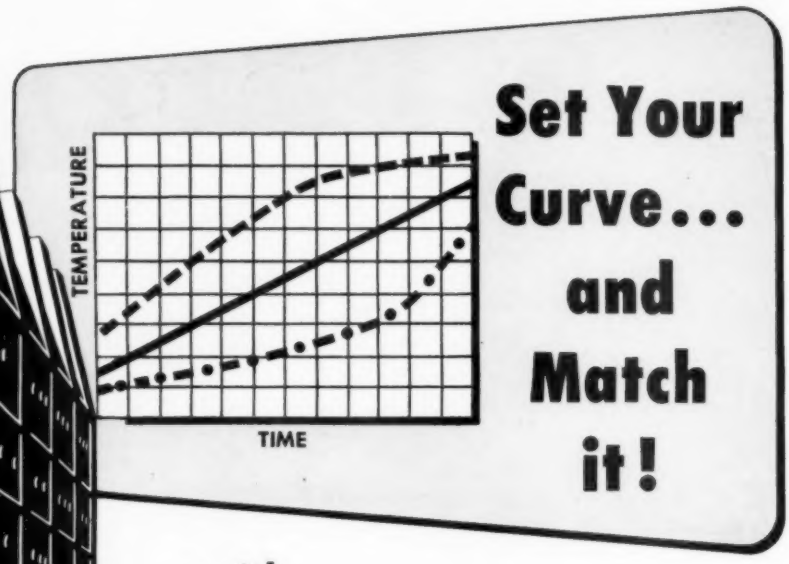
W. K. MITCHELL & CO., INC.
2946 Ellsworth Street, PHILADELPHIA 46, PA.

WESTPORT JOINT
(PATENTED)

MITCHELL PIPING
SINCE 1899

PIPING FABRICATORS AND CONTRACTORS

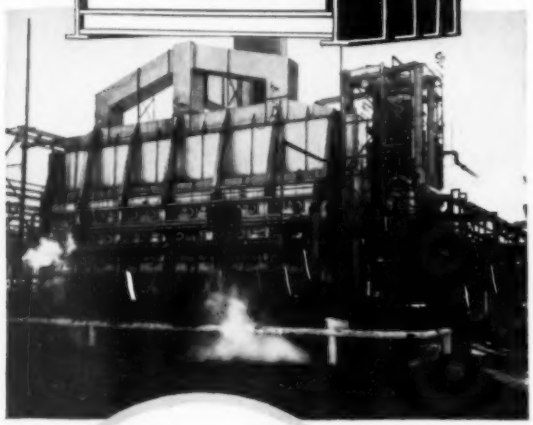




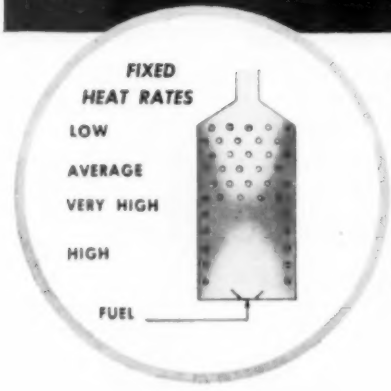
Set Your Curve... and Match it!

with SELAS Gradiation®

HEATERS



(Above) Selas Gradiation Heater installed at Phillips Petroleum Refinery.



(Left) Convection type heater, with wide variation in heating rates, small radiant surface in a large tube surface requirement, probably tube overheating, large pressure drops.

Now, petroleum engineers determine the ideal time-temperature curve for specific refining processes . . . and match it in production with Selas Gradiation Heaters.

Selas Gradiation with precisely controlled, uniform radiant heat input makes possible:

- *Flexibility* in curve shaping
- *Precision controlled* residence time
- *Positive rate-control* of oil heating
- *Complete combustion* with little or no excess air

One refinery manager says: "This radiant heat source provides a high efficiency furnace that is easily installed . . . has low maintenance and fuel costs . . . gives smooth operation with high wind velocities . . . is capable of successfully processing a wide variety of charge stocks. This selective heat input to the radiant coils produces higher heat transfer rates than the conventional heaters . . . saves initial tube costs, reduces residence time, allows high vapor velocities and low pressure drop."

Selas Gradiation Heaters offer new horizons in refining . . . whether small or large refinery, catalytic or thermal cracking. Let us send you more information. Write for new sixteen page booklet.

SELAS CORPORATION OF AMERICA
PHILADELPHIA 34, PENNSYLVANIA

Heat Processing Engineers for Industry • Development • Design • Manufacture

Planning for profits with PERCO*

Refiners rely on Perco for expert advice and consultation to improve refining performance, by the efficient utilization of Perco processes.

Perco offers many services. One of our engineers will be glad to review the economic application of the Perco process best suited to your needs.

Make the most of your throughput—*consult Perco.*

Over 175 installations licensed by Perco throughout the United States, Canada, Europe, and Latin America prove the wide application of Perco processes to current refining problems.

Now is the time to upgrade your throughput.

Write Perco today for full information.

PERCO *Division*

Phillips 66

PHILLIPS PETROLEUM COMPANY

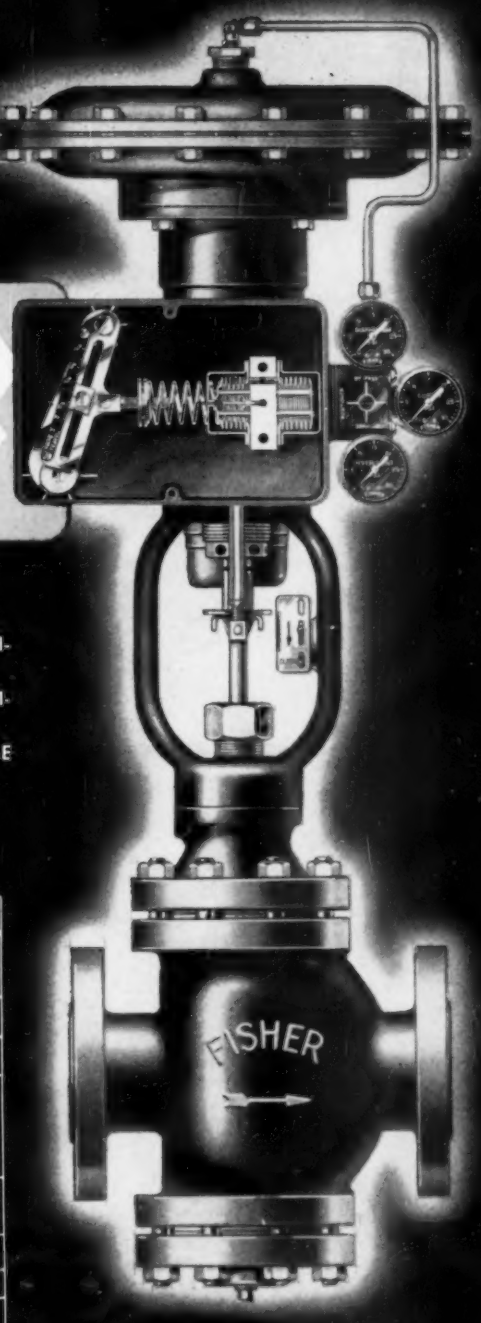
PERCO®
*A SERVICE MARK

Bartlesville, Oklahoma

(To obtain more data on advertised products see page 276)

FISHER® POSITROL®

FOR ACCURATE POSITIVE VALVE POSITIONING



FEATURES

- COMPACT — SIMPLE RUGGED
- 5 YEARS FIELD SERVICE
- EASILY ADJUSTABLE
- FORCE BALANCE TYPE OF POSITIONER
- AVAILABLE WITH OR WITHOUT BY-PASS
- USABLE AS REMOTE POSITION INDICATOR
- FOR DIRECT OR REVERSE ACTION VALVES

TECHNICAL DATA

TEST			FISHER TYPE 3500
INSTRUMENT PRESSURE SENSITIVITY CONTROLLING PRESSURE CHANGE NEEDED TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM			0.07 LB.
STEM MOVEMENT SENSITIVITY AMOUNT STEM CHANGE TO PRODUCE 2 LBS. TO 15 LBS. TO DIAPHRAGM	½" TRAVEL		0.0037" AVE.
	2" TRAVEL		0.015" AVE.
SPEED TIME IN SECONDS FOR FULL TRAVEL	SIZE	TRAVEL	
	DD	⅛"	1.2 — 1.2 SEC.
	FF	1⅛"	4.2 TO 4.8 SEC.
	GG	2"	7.2 SPC TO 9.6 SEC.
	HH	2"	10.5 TO 12.6 SEC.
LAG ERROR IN POSITION AT 9 LBS. CONTROLLER PRESSURE	½" TRAVEL		0.0006" AVE.
	2" TRAVEL		0.001" AVE.
EFFECT OF VARIATIONS IN AIR SUPPLY PRESSURE	½" TRAVEL		0.1 LB. PER 5 LB. CHANGE
	2" TRAVEL		0.1 LB. PER 5 LB. CHANGE
CHARACTERISTICS CONTROLLED P VS DIAPHRAGM P			LINEAR
COMMENTS			STABLE ADJUSTMENTS ALL EASY AND SIMPLE
AIR CONSUMPTION NORMAL 9 LBS. DIAPHRAGM PRESSURE			15.0 CU FT/HR

FOR COMPLETE DETAILS WRITE FOR BULLETIN E-3500.

FISHER
GOVERNOR COMPANY
Marshalltown, Iowa

LEADS THE INDUSTRY IN RESEARCH FOR BETTER PRESSURE CONTROL

Since 1880

REFINERY PROCESS NEWS

PUBLISHED BY REFINERY PROCESS DIVISION, THE M. W. KELLOGG COMPANY Feb.-March 1954

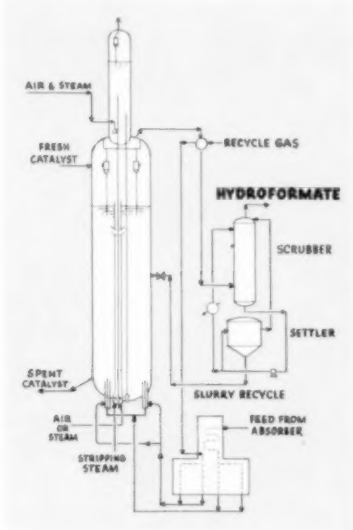
Newest Design for Fluid Cat Reforming Takes Shape in Midwest

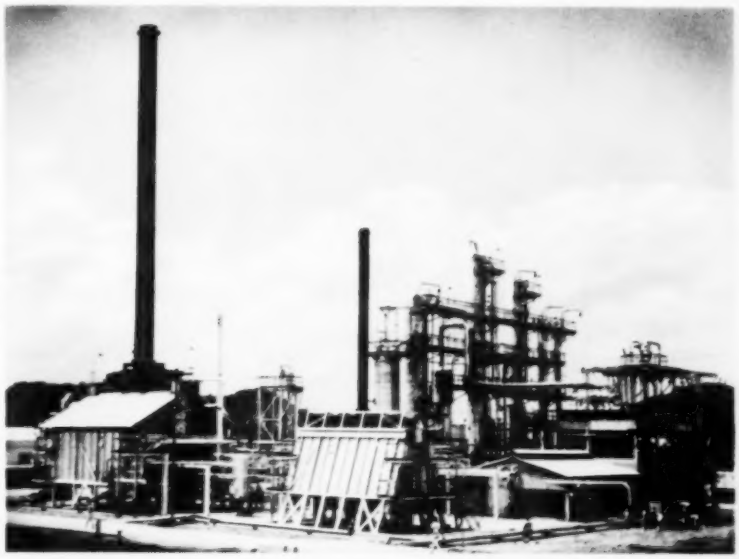
Now designed and being erected for an important midwestern refiner is the first catalytic reforming plant to combine the advantages of straight-line catalyst flow with those of Fluid Hydroforming. This is the fourth Kellogg unit, either underway or completed, employing the Fluid principle for the economical production of high octane gasoline from virgin, cracked, sulfur containing, or high boiling naphthas or mixtures of these stocks.

The new reforming unit — as compared with the original Fluid Hydroforming plant *now operating* in a Southwestern refinery—represents an over-all streamlining of the prototype.

The main points of difference, as may be seen in the accompanying simplified diagram, are as follows:

1. The reactor, stripper, and regenerator are combined in a single vessel with a common internal head separating the regenerator from the reactor.
2. Only two transfer lines, *both internally located and straight*, are required.
3. The fractionation section of the scrubber tower and its reflux return have been eliminated thus reducing both diameter and height of this tower.





Expansion of Brazilian Refinery Doubles Capacity; Improves Octane

Expansion of the thermal combination refinery at Mataripe, Bahia, for Refinaria Nacional de Petroleo, S.A., is now complete. The work has not only doubled the capacity of the original plant (also designed and erected by Kellogg) but it has materially improved the octane of the total refinery gasoline pool through the addition of a "Polyco" catalytic polymerization unit.

The largest portion of the expansion project was the substantial duplication of the initial plant (shown above) which was the first complete refinery in Brazil. The Mataripe installation represents the most modern type of combination thermal processing, and is the only plant ever designed to operate on indigenous Brazilian crudes.

Each combination unit is operated from one central control room. The refinery employs a minimum of intermediate storage tanks and processing vessels. It combines low investment cost and reduced operating expense with the production of high quality gasoline and other petroleum products.

The benefits of adding the Polyco unit to the processing sequence are demonstrated by the octane improvement of the total gasoline pool. It has been increased by 2.5 points (motor method). The finished refinery gasoline now meets the market octane requirements with the addition of one-third less lead than was previously needed.

Following the successful execution of the Bahia expansion program, Kellogg is currently engaged in another complete combination thermal refinery for Refinaria de Petroleos de Manguinhos, S.A., at Rio de Janeiro. These new facilities will be capable of processing 10,000 barrels per day of imported crudes.

These projects at Mataripe and Rio de Janeiro, together with the installation of facilities near Sao Paulo for the production of nitrogenous fertilizers from hydrocarbon raw materials, are indicative of Kellogg's extensive participation in Brazil's rapidly growing petroleum processing industry.

(For a detailed reckoning of the advantages of modern combination processing write for a copy of KELLOGGRAM #1, 1954. Address the Refinery Process Division, The M. W. Kellogg Company, 225 Broadway, New York City 7.)

(SEE REVERSE SIDE)

REFINERY PROCESS NEWS

CONTINUED FROM PRECEDING PAGE

Operating Report On First Orthoflow Erected in U. S.

The first U. S. Orthoflow catalytic cracker of the Model "A" design has just completed a continuous run of nearly 10 months at Cities Service Ponca City (Okla.) refinery. Operating reports reveal excellent performance.

During this period the unit charged approximately 9,200 BPD as compared to 8,350 BPD design and has burned 10,600 lbs./hr. of coke as compared to 9,000 lbs. design. Catalyst stack loss was about one ton daily or 0.22 lbs./barrel of fresh feed.

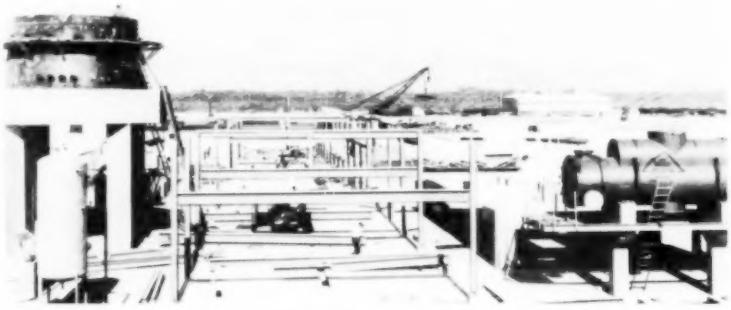
The shutdown just recently completed was a scheduled turnaround. Inspection of the Orthoflow revealed the unit to be in excellent condition, and on the basis of conditions found at shutdown, it is probable that the plant could have been run for two years without difficulty had the refiner so desired.

Since the Model "A" Orthoflow was first introduced, Kellogg has also brought out the Model "B", which has its regenerator atop the reactor, just the reverse of the arrangement of the initial type. The first of these units recently went on stream smoothly at Pure Oil's Toledo refinery. Operating reports show even better results than those obtained in the prototype.

One of the major advantages of the Orthoflow unit is the straight-line flow of catalyst and catalyst-oil mixtures. This virtually eliminates the erosion problem generally associated with conventional catalyst transportation systems.

A Refinery Grows in Kwinana . . .

Work at AIOC's Kwinana refinery in Australia is well along as may be seen from these views of two important processing steps in the complete 70,000 BPD plant. Shown above is the framework of the furnaces and the foundations of the crude distillation units. Below is the catalytic cracking area, showing the pedestal and reactor skirt of the Orthoflow unit.



One of Five Alkylation Units . . .

This is one of five sulfuric acid alkylation plants now being erected by Kellogg for several refiners in the U. S. and abroad.

Like the others this one for American Mineral Spirits Company at Toledo, Ohio, incorporates Kellogg's unique reactor and auto-refrigeration system, which not only improve the product quality but also produce important savings in initial investment and operating costs.

There are three principal reasons for the success of the Kellogg reactor: (1) high ratio of isobutane to butylene without concomitant increases in utilities and equipment, (2) efficient mixing in reaction sections at low horsepower, and (3) maintenance of relatively high acid concentration during reaction due to exclusive "cascade" design.

For further information, technical data, etc., on any refining process, write

REFINERY PROCESS DIVISION

THE M. W. KELLOGG COMPANY

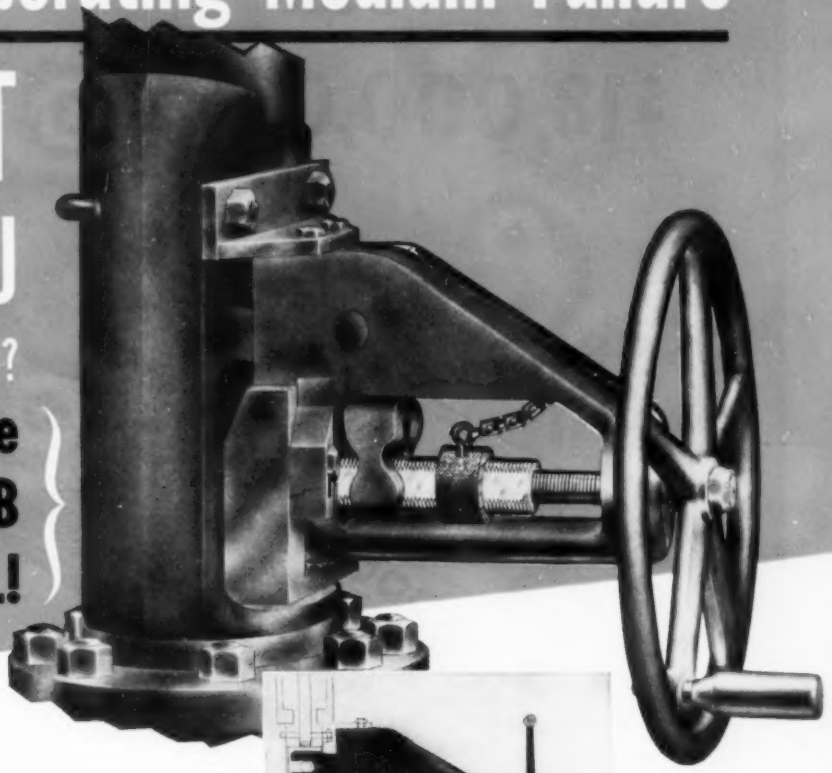
225 Broadway, New York 7, N. Y.

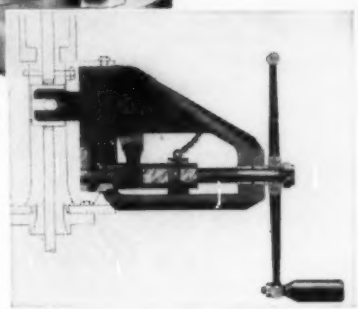
Also Jersey City, Los Angeles, Tulsa, Houston, Toronto, London and Paris

KELLOGG PULLMAN

Would an Operating Medium Failure SHUT YOU DOWN?

Not if you have this BS&B MANUAL CONTROL!





If the diaphragm control valves in your plant were suddenly rendered inoperative by failure of the operating medium, (or in rare instances by diaphragm failure within the valve), would you be forced to shut down immediately while repairs were made? Not if your valves are equipped with the BS&B Type Y Continuously Connected Side Handwheel for emergency manual control!

The Type Y is especially designed for use with all BS&B Diaphragm Control Valves, including Types 15 and 86, and the pressure balanced Type 73, where no by-pass is provided around the valve. It has a cast iron frame which fits onto the various Climax Valve Yokes. Working parts are of stainless steel, and it is equipped with an Ampcoloy jack screw, "Oilite" bearings and a large handwheel for ease of operation.

With the Type Y, control valves can be manually positioned in either direction independently of the normal controlling impulses. Its mechanism provides stops so that travel can be set to cover any portion of the complete valve stroke.

Avoid costly shut-downs due to operating medium or diaphragm failure! You can keep your plant operating indefinitely on an emergency basis if your control valves are equipped with the BS&B Type Y Continuously Connected Side Handwheel!

For complete information on any BS&B Climax Control or accessory, ask your BS&B Man, or write to . . .

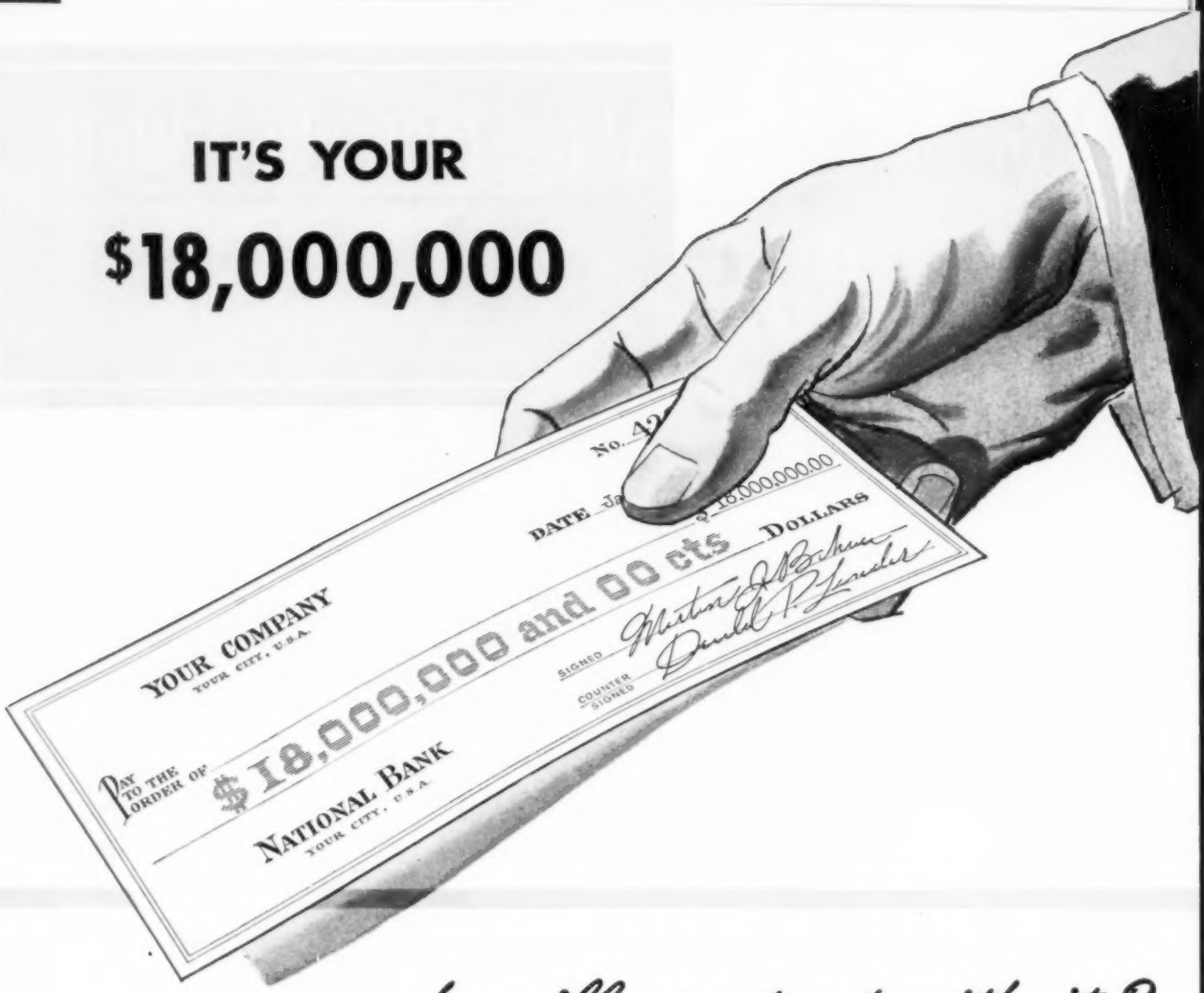
CLIMAX BS&B CONTROLS OVER 60 YEARS

BLACK, SIVALLS & BRYSON, INC.

CLIMAX CONTROLS DIVISION, DEPT. 4-D2

7500 East 12th Street Kansas City 26, Missouri

IT'S YOUR
$18,000,000



. . . who will you trust with it?

WHEN your company invests that kind of money in new plant construction you will have to have confidence—a lot of confidence—in the people you trust with the job.

You can find plenty of evidence of complete confidence in McKee among some of the world's largest corporations in the industries we serve. Most of the big names in these industries have called on us again and again for McKee design, engineering and construction services . . . the type of sound thorough efficient services you want for *your* money.

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TRANE GC Fluid Cooler, fan diameters from 6′ to 16′.

5 reasons for specifying TRANE fluid coolers

. . . and they all add up to fewer shutdowns . . . less trouble . . . lower operating costs

1. Vibration controlled! TRANE Fluid Coolers wear longer... require less maintenance . . . because TRANE engineers have virtually eliminated causes of vibration. Fan and motor mounted *independently* of rest of unit, fans dynamically balanced. Solid, oversized fan shaft firmly mounted in giant thrust bearings. Drive components aligned at factory, shipped assembled. Orifice ring designed to *match* the fan.

2. Fin and tube "joined forever." Mechanically bonded to tube, fins can't loosen. No solder is used. Tubes contract and expand independently of casing, reduce strain.

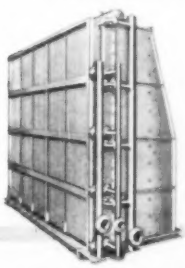
3. Coils resist corrosion. Available in wide variety of metals including cupro nickel, admiralty, red brass, copper, aluminum, monel, stainless steel, special metals, to solve your corrosion problems.

4. Extra strong framework. Unit can be used for stationary or portable installations without additional bracing. Stands up under wind and shock load.

5. Automatic controls cut power costs. Automatic controls regulate leaving temperatures down to 2 degrees plus or minus . . . adjust both motor speed and air shutter openings for most economical operation. And since surveys show most units operate at design temperatures only 10% of time, savings in fan horsepower yield big savings in operating costs.

Get all the facts before you plan your next job.

Contact your nearest TRANE Sales Office or write TRANE, La Crosse, Wis., for Bulletin DS 395, containing capacities, performance curves, construction details, roughing-in dimensions, installation details and specifications.



TRANE EC Fluid Cooler, 14 sizes, fan diameters from 18" to 120".

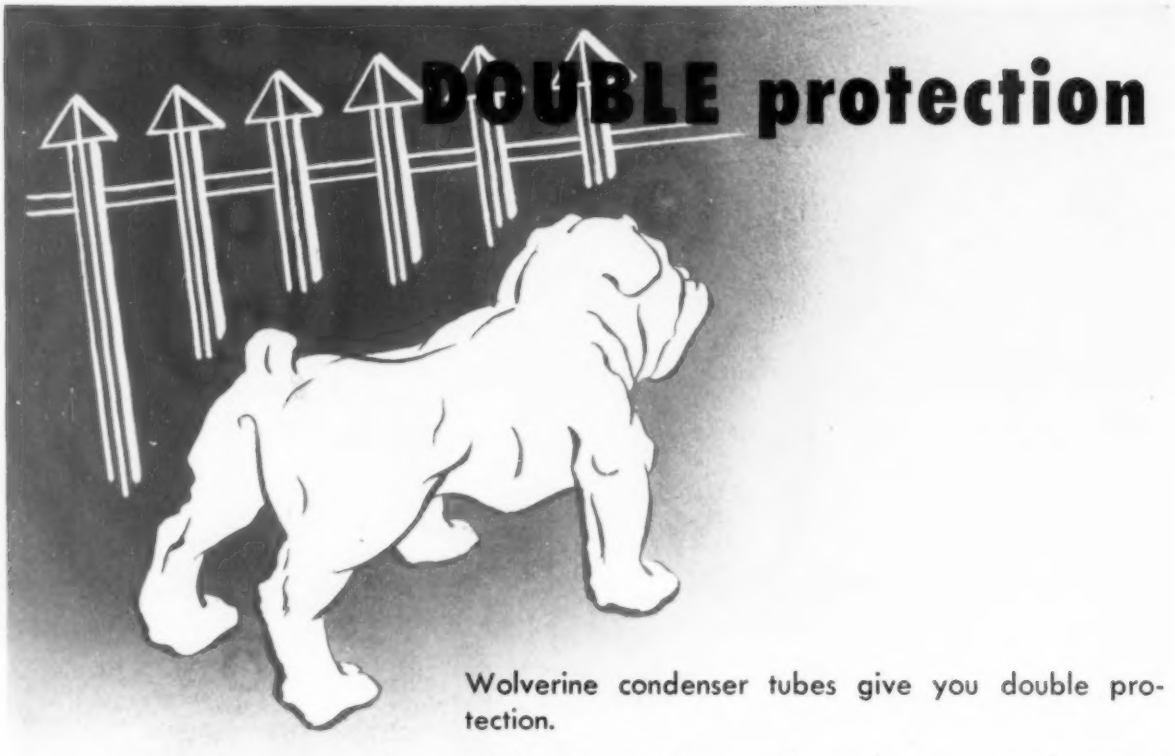
You can plan on longer "life expectancy" with

TRANE

dry-type fluid coolers

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U. S. and 14 Canadian Offices.

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT



Wolverine condenser tubes give you double protection.

Wolverine condenser tubes of copper and copper base alloys contain both arsenic and phosphorous—two of the best inhibiting agents that could be added to condenser tube alloys as protection against dezincification.

As you know, phosphorous is the best possible densifier of metal. It makes molten copper more fluid, and the resulting castings more sound and free of undesirable porosity. Arsenic, in itself a good inhibitor, is also added.

It adds up to double insurance or double protection by assuring a sound tube and resistance against dezincification.

Before retubing is necessary, write for Wolverine's new Condenser Tube Book. It's packed with information on sizes and alloys.

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.
ESTABLISHED 1916
Manufacturers of Quality-Controlled Tubing
1441 CENTRAL AVENUE • DETROIT 9, MICHIGAN
Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

EXPORT DEPT., 13 E. 40th ST., NEW YORK 16, N. Y.

 (To obtain more data on advertised products see page 276)

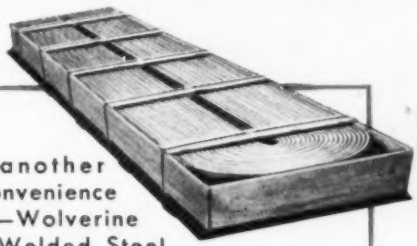
WHERE CORROSIVE CONDITIONS ARE NOT SEVERE . . .

The ideal tubing to use in your heat exchangers and condensers is Wolverine Electric-Welded Steel Tubing—for three reasons: 1) its low cost, 2) its long life, 3) its ready availability.

Where corrosion is not a major problem, this tubing can be used at higher temperatures than most nonferrous tubing. Its principal application is in the handling of industrial waters used for cooling purposes, neutral and alkaline solutions, and various chemicals of a non-corrosive nature.

Wolverine welded steel condenser tubes are particularly efficient in installations of condensers and heat exchangers in oil refining. They are easy to fabricate.

The tubes are made to A.S.T.M. heat exchanger specification A 214-51T and to Government specifications, in sizes up to 2″ O.D. They are available in straight lengths up to and including 30 ft.; longer lengths on special order.



Here's another great convenience for you—Wolverine Electric-Welded Steel Tubing can be furnished in U-bends to your specifications in a new expendable box type pallet. Delivered to you in this new pre-arranged package, Wolverine Electric-Welded Steel Tube has the plus value advantages of decreased installation and handling costs; decreased unit costs by eliminating one tube sheet; and a reduction, by one-half, in rolling-in operations.

Individual tube bends take care of differential expansion, eliminating floating head problems.

Send for a copy of our new Electric-Welded Steel Tube catalog giving you much helpful information.

ESTABLISHED 1916

WOLVERINE TUBE DIVISION

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Manufacturers of Quality-Controlled Tubing

1441 CENTRAL AVENUE • DETROIT 9, MICHIGAN

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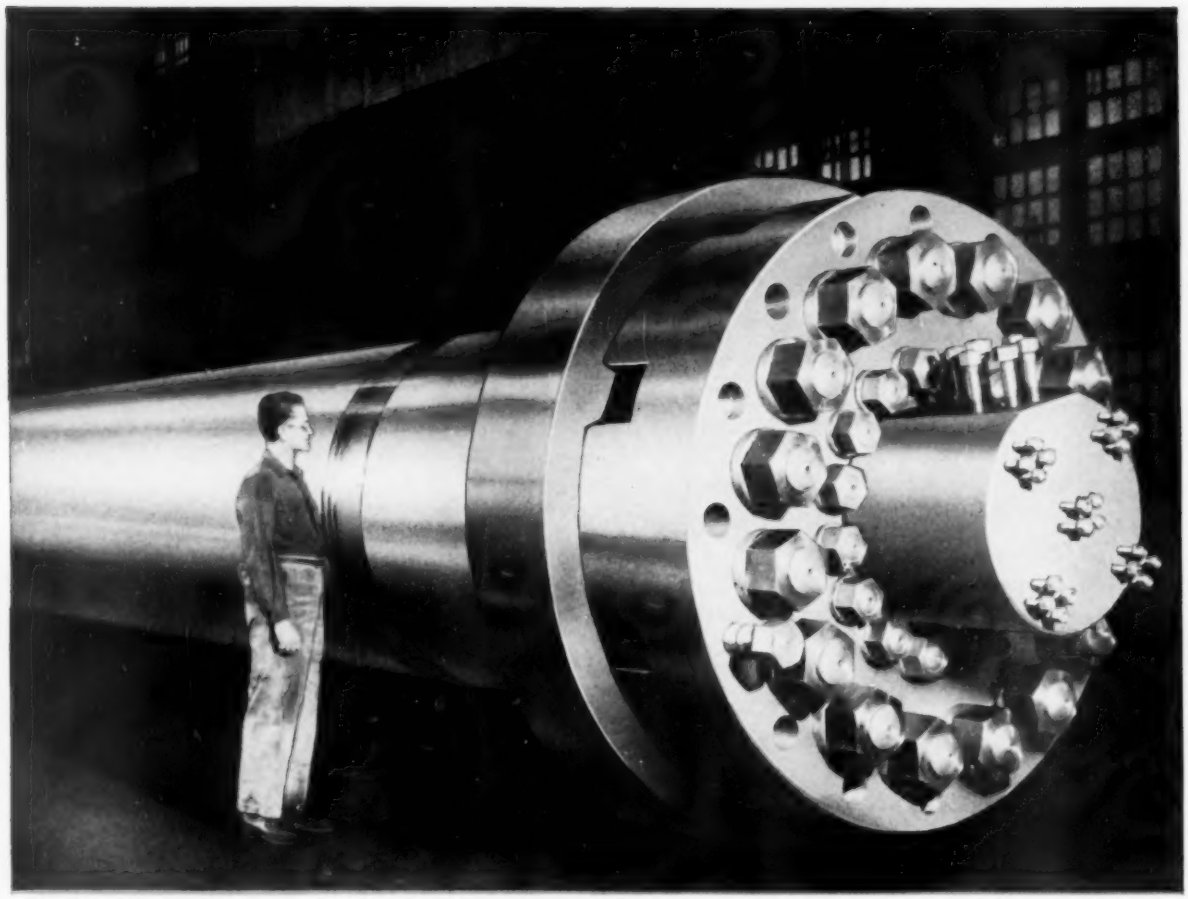

PRESSURE STARTS *Right* AT THE BEGINNING!

Product—Converter
Working Pressure—4,500 P. S. I.
Inside Diameter—45"
Tensile Strength—75,000 P. S. I.
Material—Chrome-Vanadium Steel
Closure—Bridgman
Installation—Union Carbide and Carbon Corp. Texas City, Texas

Midvale pressure vessels are right from the start. Designed right in cooperation with customer's engineers. Made right from the pouring of the steel to final machining. Proved right by extensive sonic, hydrostatic, strain-gage and X-ray tests.

This big brute is an example of Midvale's vast experience and facilities and is the result of complete cooperation in design and building with the engineers of Union Carbide and Carbon Corporation.

This pressure vessel started as a 550,000 pound ingot of chrome-vanadium steel, poured by Midvale's steel making specialists. Then carefully hollow forged to rough shape on 14,000 ton and 7,500 ton presses . . . hydrostatically tested at 9,000 P. S. I. for a working pressure of 4,500 P. S. I. It has been successfully operating for years at Texas City, Texas.

Forged steel converters, reactors, separators, autoclaves . . . any size or type . . . Midvale has the complete facilities and the experienced craftsmen to make them to withstand high pressures, high temperatures and resist corrosion. Next time your plans include pressure vessels get in touch with Midvale. Let our engineers work with you from initial design to final installation.

THE MIDVALE COMPANY- Nicetown, Philadelphia 40, Pa.

Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

MIDVALE

FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

DEPENDABILITY IN CATALYSTS CANNOT BE SEEN

Top uniformity and dependability are available to you in Davison's microspheroidal (M-S*) or ground (DA-1*) synthetic fluid-type cracking catalysts. The accompanying photomicrographs show the physical characteristics of the DA-1 and new M-S catalysts produced in Davison's Cincinnati plant. Uniform physical and catalytic characteristics result from Davison's modern facilities and years of technical experience and research. Experienced Davison Field Service Engineers—complete laboratory facilities—are all part of Davison Dependability—Dependability with the big "D".

*T.M.T.D.C.C.

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THE DAVISON CHEMICAL CORPORATION

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

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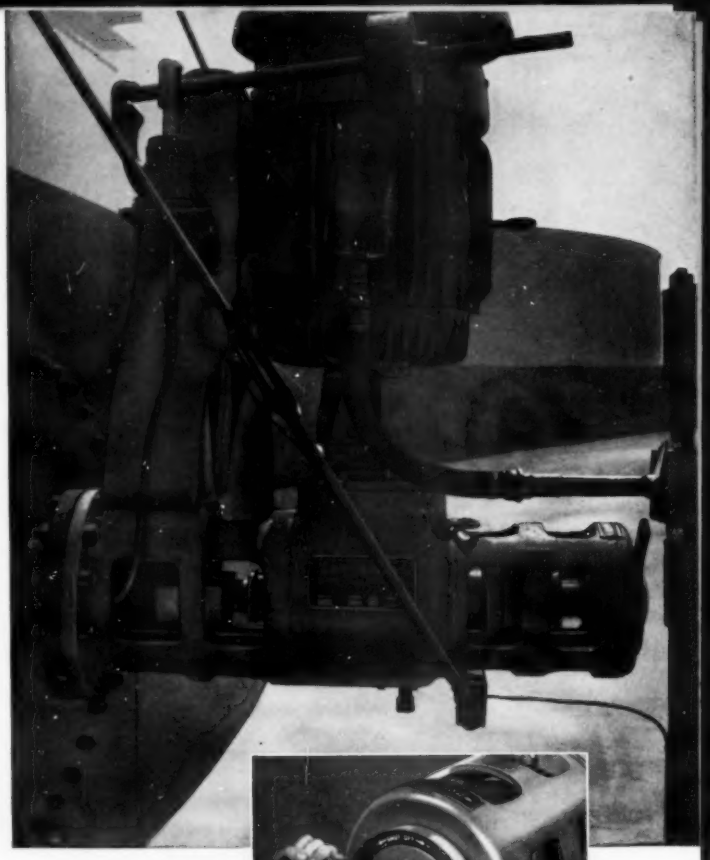

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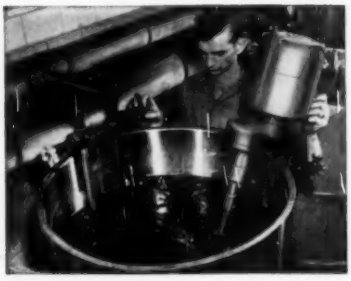

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PETROLEUM PROCESSING
FEBRUARY 1954

Gasoline Additives—Yes or No?

Majors choose sides over best method—if any—to lick preignition and spark plug fouling

A PETROLEUM PROCESSING Staff Report
By the Editors

A BATTLE-ROYAL has broken out in the refining industry over the question of whether or not automobile engine deposits are a serious matter today—and what can be done to solve the problem if it does exist.

A difference of opinion as to the seriousness of preignition and spark plug fouling as caused by such deposits—as well as to the effectiveness of gasoline additives designed to cure them—sparked a break between Esso Laboratories Research Division, Standard Oil Development Co. and Shell Oil Co. last month at the Society of Automotive Engineers' meeting in Detroit.

On one side are Shell and other refining and marketing companies using the TCP gasoline additive under Shell license, together with refiners and marketers who have come out with their own tricresyl phosphate type additives.

On the other side are Esso and other companies relying on higher octane gasoline without such an additive to cure the problems of preignition and spark plug fouling for which TCP and associated additives are prescribed.

Where the controversy will end is as yet unforeseeable, but it was evident that this was only the beginning of a long, drawn-out argument.

To the general public, the diametrical views voiced by Esso Laboratories and Shell may seem strictly a fight to sell more of their respective gasolines. Obviously a sales battle does exist—and has existed ever since the tricresyl phosphate type additives were introduced about six months ago.

But this sales spotlight of the moment hides an even more important encounter taking place between two camps of oil research men. Their ultimate objective is to determine the best way to produce the fuels and lubricants needed today as well as four years hence when 10:1 compression ratio engines are expected to reach the market.

The answer is not simple. As of now, there are several possible solutions to the problem of combustion chamber deposits and their effects on automobile engine performance and octane requirements.

1—Manufacture of higher octane gasoline, satisfactory for use without additives in higher compression engines.

2—Use of some kind of gasoline additives in conjunction with 98 octane fuels which are high in aromatic content.

3—Use of lighter and better motor oils, perhaps compounded with additives to reduce deposit forming possibilities and maintain wear properties.

4—Development of completely new refining techniques, currently unavailable.

5—Advancements in engine design, metallurgy, and automotive engineering which will alleviate combustion problems.

Final solution of more compatible fuels and engines will undoubtedly comprise an element of all or most all of these approaches, engineers attending the SAE sessions felt. There is general industry agreement that 98 octane fuel is close at hand. And, there seems little doubt that motor oils will tend toward the lighter side, with oils on the order of SAE 5W-20 predominant.

None of the additives evaluated by Esso in the studies reported to the SAE seem to provide sufficient advantage in minimizing the problems associated with combustion chamber deposit formation to make their use in today's motor gasolines attractive. This was the flat statement in the conclusions in a paper, "Gasoline Additives," prepared by C. O. Tongberg, N. V. Hakala, L. E. Moody, and J. B. Patberg, Standard Oil Development Co., and presented by Dr. Tongberg. It covered not only tricresyl phosphate types, but also limited work with boron and silicon compounds—proposed as deposit modifiers, solvent compounds—proposed as fluxing agents; and fluorine compounds—fluorinated hydrocarbons and amines proposed likewise as solvation agents.

Other materials tested by Esso included salts of alkaline metals as well as a non-metallic additive, dimethyl formamide, as combustion catalysts. All of these showed little promise.

Tricresyl phosphate, selected as being typical of the readily available phosphorus type compounds, provided less wild ping and more control of preignition, but greater power loss, poorer fuel economy, and no advantage in spark plug life, according to Esso's fleet tests.

The major problem resulting from combustion chamber deposits, in Esso's paper, is cited as the octane requirement increase. Neither preignition nor spark plug fouling is critical in the cars on the road today, the Esso Laboratories engineers maintained.

Less than 7% of the current engines could have

such a problem as preignition, Esso contends, and most of them would not have that problem if a higher octane premium gasoline were used.

With the continued trend to higher compression ratio engines, the relative importance of the various problems resulting from combustion chamber deposits may change. Preignition, for example may become a critical problem, Esso said.

Field studies on tricresyl phosphate were carried out by Esso using 16 late model cars (1951 and 1953) operating under controlled conditions. A high quality commercial gasoline of 94.5 research octane number and an SAE 5W-20 motor oil were used. Half the fleet was operated on this fuel without the additive and other half on the same fuel to which 0.2 theory of the phosphorus compound was added. The tests were continued to 7600 miles.

In addition to the usual octane requirement determinations, preignition (wild ping), spark plug misfiring, power losses, and fuel economy were determined throughout the test period.

Wild ping type preignition is reduced by the additive. For example, during the course of the test, wild ping occurred in 6 out of the 8 cars operating on the base fuel during the warm-up accelerations prior to rating the cars. It did not occur with any of the cars containing the additive in the fuel. On a percentage basis, wild ping occurred in 35% of the warm-up accelerations prior to ratings made after the 3500-mile point on the cars without tricresyl phosphate in the fuel, compared to none on those with the additive in the fuel.

The additive, however, was not effective in preventing preignition as determined by "after-running." In this case, after a power determination was completed on the chassis dynamometer (ratings were made at 20, 30, 40, and 50 mph. at full load), the car was slowed down on the dynamometer to 30 mph. at full throttle and the ignition key turned off. Under these conditions, nearly all of the cars on both fuels showed some tendency to afterrun.

Detonation requirements went up an average of about 0.8 octane number for the cars using fuel with additive compared with those using the base fuel. Further field and laboratory tests on this factor bore out the results of the fleet experiment. Octane number increases in these latter runs were 0.8, 0.5, and 1.0.

A consistently greater power loss was found with the 8 cars operating on the fuel containing additive (5.0%) than with those on the base fuel (2.8%). While this difference is small, it is based on the average of a large number of determinations for each set of cars at various speeds and mileage points.

There was also a slight difference in fuel economy in the tests: 17.7 mpg. for cars using the base fuel and 17.1 for cars using the additive fuel.

Tests were inconclusive on effects of the tricresyl phosphate on spark plug fouling. In fact, no fouling was observed with the base fuel and therefore, Esso pointed out, there was no chance to show an improvement. The criterion used was a full throttle acceleration from 20 to 70 mph., at roughly 1800-mile intervals prior to determining the octane requirement of the cars.

"Dirty" engines were studied also in an Esso test on the fuel additive. This was done by switching the fuels in the cars in the initial field test, and running four instead of eight cars on base fuel with and without the additive. Octane requirements were determined at 400, rather than 900 mile intervals; and the cars were operated an additional 2000 miles.

The major difference noted was an increase in detonation requirements of the cars switched to the additive-containing fuel. This averaged about 3 octane numbers and compares to a 1 octane number increase for the cars which were switched to the base fuel. These results are in general agreement with the earlier tests on clean engines.

With respect to effects of the additives on fouled plugs in dirty engines, little in the way of conclusive results was obtained.

Lack of preignition problems in today's cars emphasized by Esso was based on an analysis of various car octane requirement surveys in which large groups of cars had been evaluated. The information included data from:

1—An Esso Laboratories 1952 survey of the octane requirements of 115 cars selected on a statistical basis to represent the 1952 car population (1940 and newer only).

2—A survey of 69 late model (1948-1953) cars selected by make, but not car year, to approximate the 1953 car population. These cars were chosen deliberately to have high carbon mileage.

3—A survey conducted in Texas of 46 miscellaneous 1949-1953 model cars.

4—The Coordinating Research Council's 1952 Survey of car octane requirements. This CRC survey included mostly 1951 and 1952 cars. They did not represent a statistical cross section of cars on the road, because 20 to 45 cars of each of 10 different makes were evaluated, without regard to the fraction of the total car population represented by the particular make.

Essentially all of the cars in the surveys were actually post-war models. These would be expected to be somewhat more critical with respect to preignition tendencies than prewar cars, which still represent about 25% of the total car population.

Based on all the surveys, preignition is a limiting factor in determining car octane requirements in less than 7% of all cars, even if no allowance is made for the number of less critical prewar cars on the road.

Spark plug fouling was checked in one instance by reviewing the maintenance records for a group of 16 cars (1951 models) equipped with overhead valve V-type engines. This particular model has been considered to be very sensitive to fouling.

Plug replacement was 3% due to fouling in this test, where 25 plugs were replaced out of a total of 784 used. The cars had been used in controlled field tests involving low to moderate speed, urban and suburban, operation for 5000-10,000 mile individual test periods. Engines were cleaned and new plugs installed between tests. In 98 individual car test periods, covering well over a half-million miles of operation with a wide variety of fuels and lubricants, the 25 plugs changed were in only four of the cars.

This is seen as a low incidence of fouling when it is considered that the type of driving is very severe on plugs.

Little power loss from fouled spark plugs was found by Esso in still another study, on a group of 72 cars owned by laboratory employes. These were 1948-1953 models selected by make, but not car age, to approximate a statistical cross section of the 1953 car population on the road. An attempt was made to select cars with reasonably high mileages since the last previous spark plug adjustment or change, to obtain cars that would be critical with respect to plug fouling.

Power ratings were first obtained on the cars on a chassis dynamometer at 50 mph. and full throttle in the "as received" condition. New plugs identical to those already in the car were then installed and the power rating redetermined. The difference in observed power with the new plug contrasted with the "old" plugs was taken as a measure of the extent to which fouling occurred. It also shows the maximum improvement in power that

might be expected if fouling were completely eliminated.

Results showed that four cars, or 6%, gave an increase in power of 10% or more. Three, or 4%, gave increases of 5 to 10%. The remaining 90% gave less than 5% power increase, and the average increase for this latter group was 1.6%.

In direct opposition and defense of tricresyl phosphate, Shell presented a prepared rebuttal which concluded that:

1—There is currently a definite spark plug fouling problem.

2—Preignition is a problem and is serious in engines of recent design.

3—Tricresyl phosphate type additive is effective in eliminating or minimizing both plug fouling and preignition.

New research data confirming the effectiveness of tricresyl phosphate was reported by R. J. Greenshields, director of Shell's Wood River, Ill., research laboratory. He cited reports of tests made by Sun Oil Co., General Motors Corp., du Pont, and independent research organizations, as well as by Shell.

A severe road test on eight new 1952 cars under city driving conditions conducted by the Southwest Research Institute, he said, showed that cars using tricresyl phosphate went 170 to 250% farther than cars using ordinary fuel before spark plug fouling began. He added that two of the cars that had been fouled in the test with ordinary gasoline were run on the same schedule for 300 miles using gasoline with tricresyl phosphate and both regained 60% of the acceleration performance that had been lost.

Concerning power loss from plug misfiring, he said that in a Shell laboratory test a typical engine that had been fouled using regular gasoline had only 87% of new spark plug power, but after eight hours of operation with fuel containing tricresyl phosphate, the power was back at 98.5% of new plug power.

Further spot surveys made by Shell on privately owned cars on the East and West Coasts indicated that 30 cars —known to be misfiring from fouled plugs—were run on two to four tankfuls of fuel with tricresyl phosphate and the misfiring was eliminated in 26 of the cars. The Shell man said also:

"A Sun Oil SAE paper reported that tests on 30 cars in normal service showed that '95% gave preignition on commercial fuels.' A du Pont paper delivered at an American Petroleum Institute meeting reported a prevalence of preignition in many cars under low duty city driving conditions. This paper also showed in laboratory and road tests that a 'fuel additive X,' (tricresyl phosphate) could control preignition. A General Motors Research SAE paper contained data supporting the effectiveness of tricresyl phosphate in controlling preignition."

Comments from the floor following presentation of the formal discussions were numerous.

A Texas Co. spokesman declared that some tests have indicated that tricresyl phosphate shortens exhaust valve life. Other observers said that although some instances of this have been noted, in still other cases extensive road tests—by companies other than Shell—have uncovered no signs of shortened exhaust valve life due to tricresyl phosphate.

Another oil company spokesman told PETROLEUM PROCESSING that late model cars are more susceptible to spark plug fouling and preignition than are older models. Therefore, he said, any test which is designed to show a cross section of car population will show a relatively low percentage of difficulties from these two sources.

The observation was also made that in the tests by Esso, a premium grade gasoline and a high quality motor oil were used. It was pointed out that Esso's premium is a highly volatile fuel with low aromatic content and that the firm's "Uniflow" oil is generally accepted as having lower deposit forming characteristics than most oils.

With this combination, it was said, the tests were run under one of the most favorable combinations of fuels and lubes available commercially. Thus, very few cases of spark plug fouling or preignition would be encountered when testing with non-additive fuel. Similarly, addition of tricresyl phosphate to this fuel might not produce the same results as if it were used with a highly aromatic fuel.

More testing and study is needed of the entire problem before any definite conclusions can be drawn as specific causes and remedies, according to a General Motors spokesman as well as several other oil company technologists.

Engines, Fuels and Lubes—What's Ahead?

THE road down which the oil and automobile industries will travel the next three or four years now is pretty clearly defined. By 1957-58, two developments seem certain.

1—Engines with 10:1 compression ratios.

2—Gasolines of 98 octane ratings.

Although the wedding of fuels and lubricants with the higher compression ratio engines is fraught with complications, the industry is confident the complications can be licked.

Stage was set for unveiling possible trends in fuels and engine problems by William M. Holaday, Socony-Vacuum Laboratories, in his paper at the SAE meeting: "What Can We Get from High Octane Number Fuels."

He predicted 10:1 compression ratio automobile engines fueled with 98 octane gasoline within the next three or four years. He said the petroleum industry is now in the position to ask the automotive industry how soon it can produce an engine which will utilize effectively a 98 octane fuel.

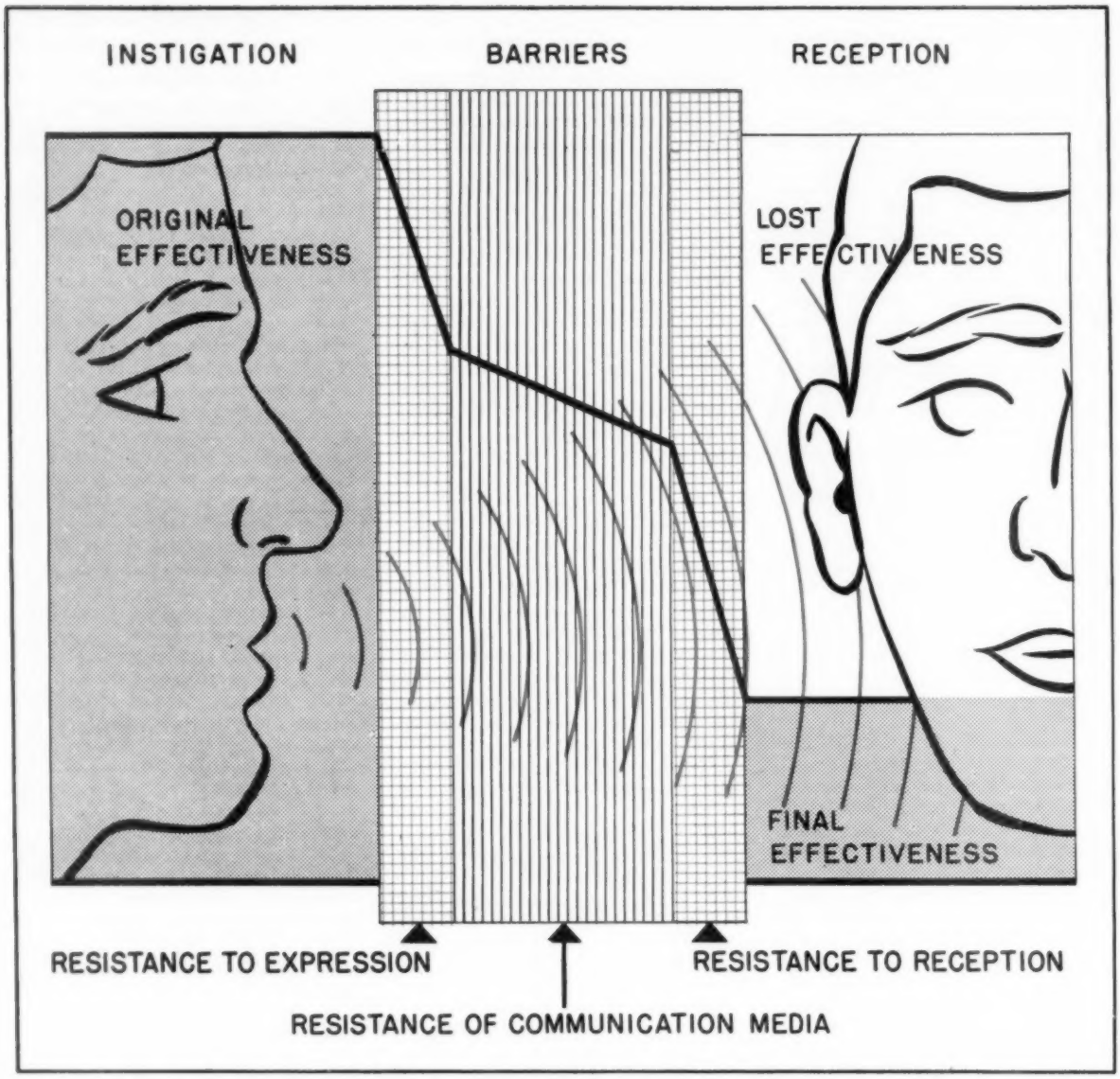
This is a reversal of the situation existing about six years ago when the auto makers asked the oil companies how soon they could produce a high octane fuel to power the high compression engines already developed.

Improvements in refining, Mr. Holaday explained, make it possible to produce a higher octane fuel at a lower cost than was possible seven years ago with the methods then available. Because of this advance in technology, the 98 octane fuel in another three years or so will be possible.

He added that some refining units are capable of producing this fuel now, but until facilities enable nationwide distribution, 98 octane gasoline cannot be considered marketable in quantities sufficient to warrant 10:1 engines now, or next year.

Mr. Holaday said that to produce 98 octane fuel by catalytic reforming will actually mean a saving of about 7.7% in the amount of crude oil required to produce a specified volume of gasoline. He added:

"Increasing octane number, up to the 98 level, is not an expensive luxury but rather a means of achieving economy—more miles per barrel of crude and more miles per dollar. . . . The potential savings in crude is equivalent to adding 2 billion bbls. to this country's proved reserves."



LIKE HEAT TRANSFER, communication transfer hits three barriers of resistance, reducing final effectiveness in message reception

How to Get Your Story Across

Here are tips and a checklist to help you improve your communications with others

By *MARSHALL SITTIG*

Princeton, N. J.*

DO your employees support wholeheartedly your decisions? Are you getting the co-operation you need from other departments? If your answer is "No" to either of these, the reason may very well be ineffective communications. You may have failed to sell yourself or your plan of action to others.

What do you do? How can communication be improved? First, sit down and analyze the process of getting an idea effectively transmitted from your mind to that of your audience—whether it be people in your business organization, in a classroom, at a political rally, or around a Board of Directors' table.

Three barriers must be cleared in order to make the transfer of information effective: 1) formulate and express your message, 2) employ the proper medium for transmission of the information, and 3) penetrate and reach the mind of the audience.

The complete process may be com-

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pared to that occurring when heat is transferred from one fluid to another through a wall. Just as the major resistances to heat transfer are film resistances, so the limitations of the individual producer and consumer of a given piece of information are resistances in the path of information transfer.

The drawing above shows how: 1) an idea starts with a certain maximum effectiveness in the mind of the producer, 2) often loses some of that effectiveness in the producer's means of expression, 3) may lose still more by improper choice of media, and 4) may lose most of all because of resistance on the part of the consumer, or audience. Hopefully, that portion of the idea that does get through will kindle a spark in the audience's brain cells, so that a coordinated combination will reissue from the audience and produce the action desired.

The job then is to chop down the resistance at the three major "barriers" shown in the above drawing—original message expression, communication media, and audience reception.

The rate in any rate process is equal to the driving force divided by the resistance. For example, current flow in a wire equals the voltage divided by the resistance—I=E/R. So, the units of knowledge per unit time transferred across the "producer's film," the "consumers film," or the "media wall" are also equal to driving force (original effectiveness) divided by resistance.

Eight factors should be considered in analyzing the driving forces and resistances involved in the expression of an idea:

1—Basic understanding of subject: This may be compounded of formal education and practical experience in the field in question.

2—Adequate data: A search of published information on any topic will complement the specific data on which the immediate message is to be built. It will provide a foundation and furnish the proper perspective.

3—Vocabulary: The producer must have a command of words broad enough to permit full and adequate expression. He should then choose from that wide vocabulary a segment best suited to the audience.

4—Organization of ideas: An outline is invaluable. Systematic organization of ideas will make the message flow more smoothly, and will insure that no important points are omitted. Properly defined objectives are a necessity.

5—Speaking or writing ability: Limited ability can be aided and developed. In the case of oral presentations, rehearsals are a must. In the case of written presentations, it is wise to prepare practice drafts and solicit critical reviews by a variety of readers.

6—Know the audience: It is vital to know who the members of the audience will be, and what their interests are. In particular, the opening paragraph should be directed to such interests, and the balance of the message slanted to them wherever possible.

7—Freedom of expression: This might involve censorship in the producer's organization (for example, company policy); or it may involve bias or prejudice on the part of the individual producer. Fear of the person or persons to whom a message is addressed will lessen freedom of expression.

8—Enthusiasm: This quality is contagious and it may go far in carrying a point across. If a speaker or writer lacks enthusiasm, the audience has to work up its own enthusiasm—which it probably will not do.

Take a look at that project proposal you've got coming up, or that speech you're to give at Rotary Club next week and see how you rate on these eight points just listed.

The next problem is choice of media. What means will be used in the transfer of the information? Available media include the following, in approximate order of decreasing effectiveness (considering both speed and accuracy):

Face-to-face contact (most effective)
Conference table, using blackboard, etc.
Television
Sound motion pictures
Silent motion pictures
Overhead projectors
Staged events, playlets
Film strips with sound
Lantern slides
Opaque projectors
Radio
Recordings
Bulletin board
Letters
Exhibits, charts, posters, models
Blackboard
Newspapers
Journal articles
Books
Patents
"The Grapevine"

Six important factors have to be kept in mind in the use of any media. They are:

1—Arrangement of conferees: Certain physical relationships among producers and consumers of information have been found more effective than

For more effective communication—check these factors

Expression of an Idea

- ☐ Basic understanding of subject.
- ☐ Adequate data.
- ☐ Vocabulary of producer.
- ☐ Organization of ideas.
- ☐ Speaking or writing ability.
- ☐ Know the audience.
- ☐ Freedom of expression.
- ☐ Enthusiasm.

Use of Media

- ☐ Arrangement of conferees.
- ☐ How much of your audience will your medium reach.
- ☐ Editing.
- ☐ Filing and indexing.
- ☐ Speed of transmittal.
- ☐ Prestige of medium.

Reception of an Idea

Recognition

- ☐ Self-interests of audience.
- ☐ Human interest.
- ☐ Curiosity and novelty.
- ☐ Impact.
- ☐ Mood of audience.
- ☐ Personal characteristics of audience.

Reception

- ☐ Ability to comprehend.
- ☐ Simplicity or complexity of message.
- ☐ Association with known things.
- ☐ Palatability.
- ☐ Agreement within audience as to what they want.

Retention

- ☐ Duration of exposure.
- ☐ Repetition of theme.

others. For example; experiments have shown that a pyramidal group is more effective than a circular one. A circular group tends, however, to be a happier one. This factor also includes such points as position of a speaker or the screen he is using with respect to the audience.

2—Ratio of media circulation to audience size: No problem in the case of personal contact or a conference, but a decided factor with bulletins, exhibits, and the like. The most effective media are those wherein the total audience reached is the same as that to which the message is directed. The less effective media are those where a large proportion of the audience are people to whom the message is of no concern.

A further example: Suppose a meeting or a large conference is chosen as the media for informing *all* employes of the establishment of a new fire protection program. If, because of improper timing, it is impossible for *all* employes to attend such a meeting; the complete transmittal of information has become ineffective.

3—Editing: If the message passes through the hands of someone else between producer and consumer—particularly for preparation into a display, or a formal presentation for multiple distribution—it usually undergoes editing and rewriting. Part of an original message may lose effectiveness through omissions or alterations. Editing must be carefully planned and considered by the originator of the message.

4—Aids for stored information, efficient filing and file-search methods: Not all information is usable at the time it is produced. From the audience's point of view, the next best thing to knowing data is knowing where to find it. A good file index is essential: mechanical and electronic search aids are the coming thing. A good index in a reference book falls in this category.

5—Speed of transmittal: This could be as simple as putting a Special Delivery stamp on a letter. It could involve the time spent in a man's outer office, waiting to talk to him. It may be more complex; for example, an organizational superior who declines to pass a message on to management for action. Or, it might not be *high* speed which is desirable but rather *proper* speed, or timing and scheduling a message to coincide with some expected development.

6—Prestige of the medium: Consider the cold reaction you feel toward a mimeographed form letter in comparison to the warm reaction to a personal letter. "Don't send a boy to do a man's work." A piece of information from the top management—a decision of the Board of Directors—ought to come from the President. On the other hand, a decision that the day shift should work overtime for one week—a matter of meeting a certain production schedule—is more directly an operations problem; so the message should come from the operating superintendent.

Final major problem is consumer resistance. What are the things which can help you penetrate and reach your specific audience? There are a number of factors involved, and these may be split up into three headings: recognition, receptivity, and retention—the "three R's of audience reaction." Recognition is a function of getting attention and arousing interest. Receptivity involves learning and acceptance. Retention guarantees the audience is not only attracted and interested but also retains the message long enough and well enough to insure action.

Audience recognition is gained when a message:

1—Satisfies the self-interest of the audience member; when it answers quickly and effectively the reaction: "What's in it for me?"

2—Has human interest; when it appeals not only to the individual's interest in himself but also to his interest in other individuals.

3—Has novelty and appeals to the curiosity. A new process, new product, or new piece of equipment can and should be utilized to the utmost as the basis for effective transfer of information.

4—Has impact, which involves color, action, and size (or loudness). The intensity of initial impression on the audience where visual aids are being employed as media often depends on the use of striking color. Flashing lights and mechanical motion can be used in displays and exhibits—say with an in-plant safety promotion campaign.

5—Recognizes audience mood. Tremendous tact and extra preparational work are frequently needed to make an impression of the right kind on a hostile audience; for example, in the event of a labor problem. Most important, perhaps, is to recognize the areas of thought in which the audience is hostile and then go to work on those areas.

6—Understands personal characteristics of the audience. This involves such factors as divergent as sex and social position. The basic appeals in a message would vary as the audience varies from stenographers to toolmakers to foremen to department heads.

Audience reception is attained when the message:

1—Is at the proper intelligence level. The speaker or the writer of the message must start with what the audience knows or understands and then go on from there. It may be wise to consider giving certain personnel training courses in rapid reading for more effective understanding of memoranda and technical messages.

2—Provides association with familiar things. Comparison of the unknown with known is vital, particularly in explaining technical matters to a non-technical audience.

3—Is palatable. Written messages should be easy-to-read, simple, straightforward. Nobody wants to read sentences a half-page long. Nobody wants to struggle with a word like "infundibulate" when he can read "funnel-shaped." On the other hand, nobody wants to read material that sacrifices style for brevity.

Slides, or other audio-visual presentations can be made more palatable—through the use of color in the slides, lettering and tables that can be easily read from a good distance, or charts with few instead of many lines.

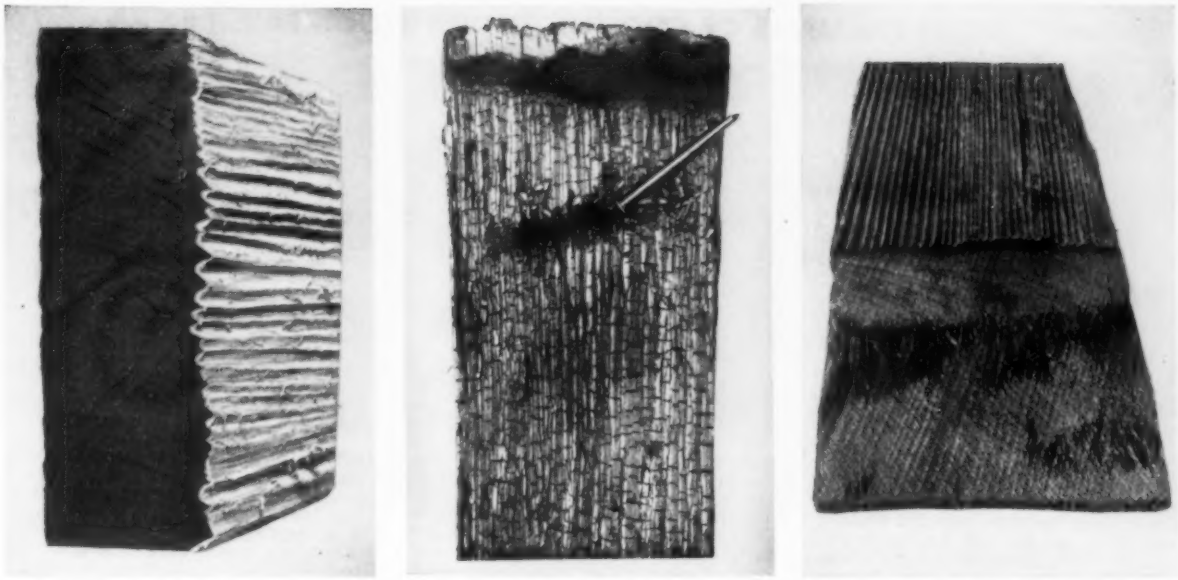
4—Finds agreement within an audience as to what is wanted. Getting a message across which pleases everyone in an audience of broad and divergent interests is virtually impossible. It is preferable to aim at the more articulate and more powerful members of a group so that they in turn may influence the others.

For the last "R," retention, there are two important factors which guarantee the message will make a lasting impression:

1—Duration of exposure. When only a brief time is allotted to a presentation, it must be done very skillfully. A logical, step-wise presentation, with exhibits, will help insure retention of an idea.

2—Repetition of theme. Advertising employs repetition to a large degree, for example, in slogans. This same basic fundamental will apply to many messages that must be put across within an industrial operation.

There is no magic formula, no fast shortcut to more effective transfer of information. Better communication can be obtained by remembering the three hurdles: 1) formulate and express your message, 2) use the best available medium for transmittal, and 3) penetrate and reach your audience. Use the detailed checklists of factors for each of these hurdles. Analyze your daily routine verbal orders, letters, and reports. Get your story across.



THREE KINDS OF DETERIORATION and what they look like: l. to r.: surface chemical, surface biological, internal biological

Cooling Tower Wood Deterioration

—Causes and suggested remedies

PROBLEMS of deterioration in cooling tower lumber, particularly in warm climate regions, can best be solved by paying close attention to proper operating practices.

The most important factor to watch in trying to minimize both chemical and biological attack on cooling tower wood is correct chemical treatment of the cooling water. This means that the pH value should be held between 7.0 and 7.5.

These are the general preliminary conclusions reached in a detailed continuing study of 103 operating cooling towers in the Gulf Coast area extending from Brownsville, Texas, to Baton Rouge, La.

The towers studied include all commercially available types and designs, ranging in age from a few months to 22 years, and confined in size to what are considered industrial towers.

The towers are in refineries, petrochemical processing plants, and steam turbine electric generating plants. The processing units include chemical manufacturing, petroleum refining, natural gas compression facilities, and the general applications of cooling towers for waste heat dissipation for distillation, fractionation, crude stabilization, thermal and catalytic reforming, alkylation, polymerization, and isomerization as well as steam condensing.

Test towers were selected at random, without regard for type of service, temperature conditions, or age. As few as one and as many as 26 towers are under study in respective plants cooperating in the program. The average is 8.6 towers per plant.

The study was made by the Cooling Tower Institute, the California Redwood Association, and a group of tower users, including many major petroleum companies in the Southwestern region. Additional assistance was provided by the U. S. Forest Products Laboratory, Madison, Wis.; the Institute of Paper Chemistry, Appleton, Wis.; Esso Standard Oil Co., Baton Rouge, La.; and Humble Oil & Refining Co., Baytown, Texas.

Direct supervision of the program was provided by the U. S. Forest Products Laboratory, Madison, Wis.; the comes from a progress report by Technical Sub-Committee No. 3 on Cooling Tower Wood Maintenance of the CTI, and made available to PETROLEUM PROCESSING by the Institute. This report covers data obtained in 1951. However, field studies have been and are still being carried out, and compilations and correlations of later data will be undertaken by CTI.

The study program was initiated in 1950 when a number of cases of rapid and serious deterioration in redwood cooling towers in the Gulf Coast area were brought to the attention of several redwood lumber manufacturers and cooling tower builders.

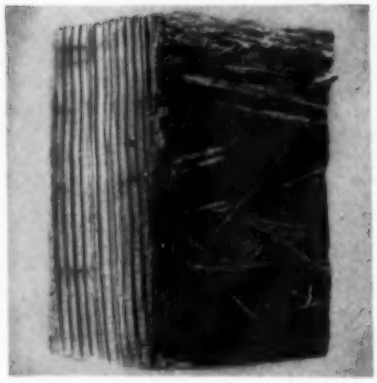
Gradual breakdown and ultimate failure of redwood in cooling towers had long been recognized, and as early as 1948 cases of moderate deterioration had been reported. However, it was not until 1950 that cases of extremely rapid deterioration were reported generally to the industry. The study program was then established as a co-operative venture among members of the CTI, the California Redwood Association, and users.

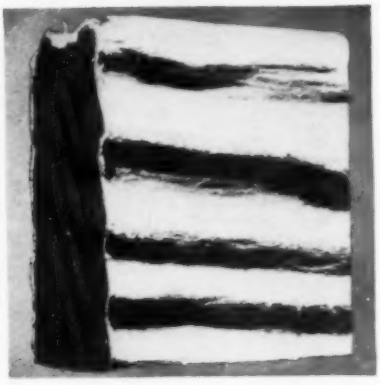
Studies have been in progress for approximately two years on the data obtained in the direct examination of the 103 towers during the summer of 1951. The conclusions reached by the sub-committee in its analysis are tentative and subject to further refinement or revision as more and better data are obtained from the current program of research, the committee has emphasized.

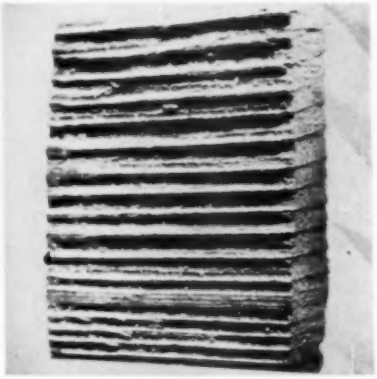
Although seven types of deteriorated wood have been analyzed, the deterioration has been segregated by arbitrary definition, for purposes of the study, into two major categories:

1—Surface deterioration, which

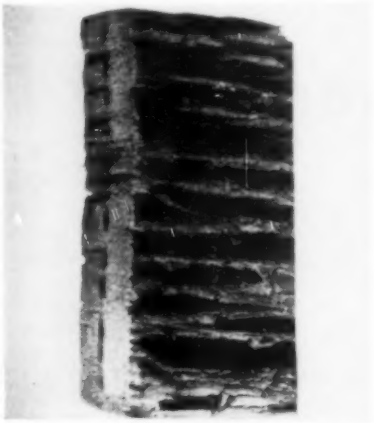
MORE EXAMPLES OF COOLING TOWER WOOD FAILURE

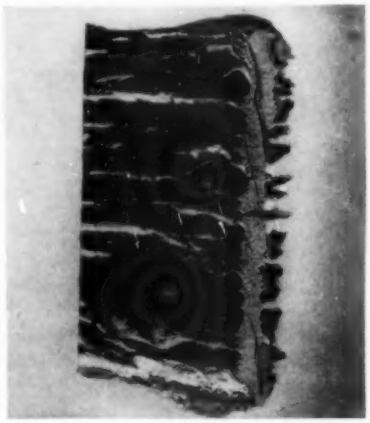






SURFACE CHEMICAL ATTACK—Wood from air inlet louver position after 10 years' continuous service exposed to air-borne fumes from acid unit (above). Position was totally dry and not exposed to circulating water. Surface is broken down so that numerous long reddish-brown threads were formed and partially separated. Sample is not typical, but shows one of the unusual forms of surface attack. Flooded area sample (above) in which delignified wood evidences a ridged surface, bleached and whitened after 12 years of continuous service. Adequate strength still remains in the unaffected wood. The picture at the right shows fuzzy external condition from surface chemical degradation after 10 years of continuous service in a tower operating with a general pH of 9.0 in a system chlorinated for algae control; no biological attack.





SURFACE BIOLOGICAL ATTACK — Where surface biological attack appears at all it shows an approximate straight line correlation with age. These three pictures demonstrate the gradual increase in intensity with increased age.

INTERNAL BIOLOGICAL ATTACK—Unusually clear example in an eliminator (above) after seven years' service in a system with general pH of 7.4 and a chlorine residual of 0.1 ppm. Sound exterior shields the degraded and seriously infected internal condition which is evidenced by a soft, punky texture. In early stages, the interior is often delaminated (above), the laminae corresponding to the annual rings. The microscope showed the summerwood was attacked first and selectively degraded, leaving the springwood in integral laminates. In advanced stages of internal infection, thumb pressure on the surface may permit detection of severe degradation due solely to action of fungi, evidencing both delamination and complete loss of strength below the sheath of sound exterior wood (see above).

may be clinically subdivided into two types: chemical action, probably entirely of chemical origin, resulting in a white fibrous surface on the wood; and biological action, preceded by the same chemical degradation that produces the fibrous surface but is evidenced by a brash, crumbly surface condition,

2—Internal deterioration: usually found within the wood and the result of fungal action probably preceded by chemical degradations similar to those which accompanied or preceded the surface deterioration, resulting in a brash, delaminated, or crumbly condition inside the wood.

Chemical attack of cooling tower wood may be controlled to a large extent by water treatment. It appears that high alkalinity and high pH values result in chemical attack. It is also known that sodium carbonate is a contributing influence in this connection. Oxidizing agents will destroy the lignin and some of the other components of the wood.

Studies conducted by the Institute indicate the pH should be maintained between 7 and 7.5. Some operators have found that sodium carbonate in excess of 100 ppm. is detrimental. Proper treatment of the circulating water can prevent chemical deterioration or stop progression of the attack. The concentration of sodium carbonate may be controlled by the use of sulfuric acid to convert it to sodium sulfate; and the chlorine residual should be maintained below 1 ppm.

The fact that biological attack seems more prevalent in towers operating with a high pH value may indicate high alkalinity encourages leaching, which lowers the resistance of the wood to decay. The incidence of decay is probably due largely to chance infection, but it is known that the resistance to attack is lowered as a result of normal leaching that occurs.

Water treating practices that prevent chemical attack will also minimize the possibility of biological infection but will not positively prevent it. Changing the water treatment will not stop the infection if it is already present.

Biological attack can be combatted with adequate sanitation measures. These should include periodic inspection of the wood, removal of algae, mud, and other deposits, and general cleansing of the entire cooling tower system. Infected wood should be removed from the tower as soon as it is discovered.

Infection by wood-destroying organisms cannot be predicted although conditions favorable to chemical attack seem to make the incidence of infection more prevalent. It may occur in any part of a cooling tower regardless of make or type. The prevalence of this kind of decay is not sufficient to warrant the recommendation that treated lumber be used.

SAVE COOLING TOWER WOOD

1—Provide correct chemical treatment for the circulating water.

2—Maintain careful control of operating temperatures in the tower.

The chemical degradation of lignin and dissolution of the natural extractives that produces surface deterioration is essentially the same reaction which may precede the fungal attacks which result in internal degradation.

High operating temperatures serve to intensify the surface attacks. Correlating data indicate that the fungal action is apparently most severe when the temperature within the wood ranges from 88 to 105° F. These wood temperatures usually correspond to inlet water temperatures from 103 to 120° F.

In the case of fungi, a tendency has been noted for the attack to spread from the area of optimum conditions to areas where conditions are less favorable for attack.

Tower design variations do not produce a significant difference in average rates of deterioration in any of the types studied, according to a statistical analysis of the available data.

There does not seem to be any correlation of economic significance between rate of wood deterioration and the type of plant service to which the tower is subjected. The 103 towers studied were in several types of industry—petroleum refining, general chemical manufacturing, and the utilities industries.

Minor water characteristics, such as phosphate and sulfate content, may well have a bearing on the rates of degradation since these salts are fungal foods. However, for the average tower, it is felt their significance is of minor economic importance. They may well be given consideration in cases of severe or otherwise unexplainable deterioration.

Simple erosion has been considered as a possible cause of surface deterioration, but field data indicate that erosion by itself is of little importance. It may be assumed that erosion coupled with the effect of the minor characteristics of the circulating water account for only a small increment of the total loss of wood due to deterioration.

Algaecides: Chlorine was the only algaecide which was used in a sufficient number of the towers to permit correlation between algaecide concentration rate. Correlations for both surface and internal degradation show close similarity.

As chlorine concentrations are increased from 0 to 1 ppm. at pH of 6.0, the rate for both types of deterioration increases very slightly. As chlorine concentrations are increased over the same range at pH of approximately 7.5, the rates of deterioration decrease. As they are raised from 0 to 1 ppm. at pH 9.0, the deterioration rates increase markedly.

Minimum total deterioration of either internal or surface type was effected at approximately 1 ppm. chlorine residual at a pH between 7.25 and 7.5.

In towers using chemicals other than chlorine as an algaecide, or in those using no algaecide at all, the limited data showed that in 80% of the towers observed surface attack was almost constant regardless of the pH of the circulating water.

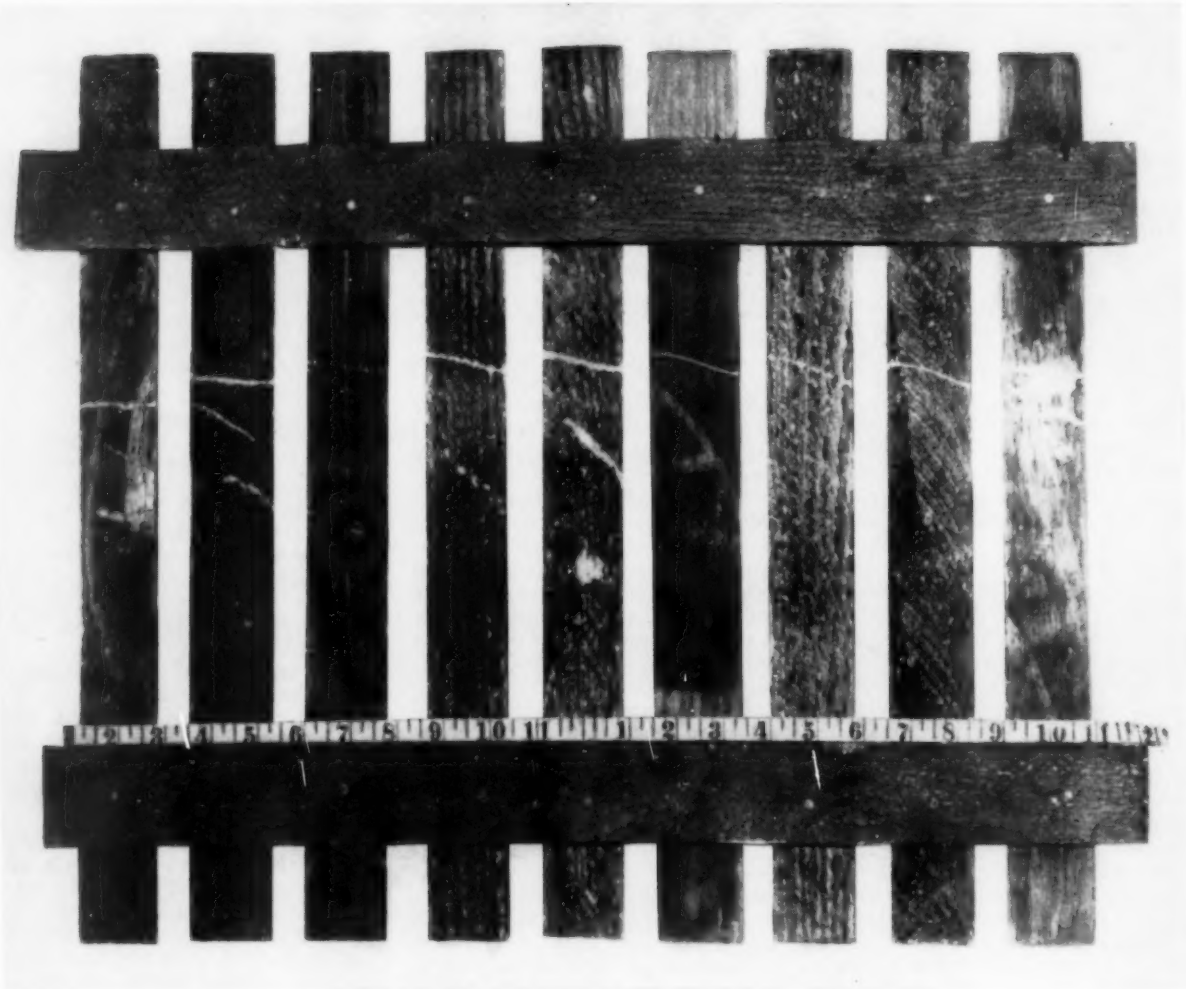
Age of the tower has no straight line relationship with the extent of surface attack, according to an analysis of the data. Rate of deterioration per year is highest in new towers and tends to decrease with age. This may be explained by the fact that a layer of degraded wood on the surface may retard further degradation, particularly the chemical surface attack, since the degraded wood forms a protective coating which reduces further attack into the unaffected wood.

Another explanation for the decreasing annual rate of surface attack with tower age is that it is extremely difficult to evaluate the amount of wood substance lost in older towers. Sizes of original members are not known and there is likely a tendency to underestimate the severity of attack in older towers.

Biological attack, on the other hand, where it appears at all, shows approximately a straight line correlation with age.

How are the types of attack detected and recognized? What are the underlying and fundamental causes of the different kinds of wood deterioration?

Chemical surface attack leaves a coating of white fibers on the wood surface. It can be recognized by both



TEST PANEL of treated wood, typical of units now under study

the color and the finely divided fibrous texture. The color alone cannot be used as a criterion, because thin scales of salts on the surface often produce a white color. The distinctive fibrous surface must be evident to classify the deterioration under this heading.

A chemical analysis of this type showed that the lignin had been removed to a greater extent than any other single component of the original wood. The extractive content was reduced to a greater extent than the cellulose and to a lesser extent than the lignin.

The possibility of this condition being the result of organic action was considered. Fungi are known which remove lignin selectively and they have been found in wood specimens from cooling towers, but they are not known to produce the usual appearance of this form of deterioration. These fungi usually operate in small pockets, leaving a cellulose residual. No cases are known in which they leave a deep bed of cellulose fibers over an entire surface, as is shown by typical examples of this type of deterioration.

It was felt that this type was more likely of chemical origin. A certain amount of such attack is unavoidable due to the leaching action of cooling tower waters, which apparently increases with greater alkalinity as evidenced by higher pH values.

A review of the chemistry of wood indicates that lignin can be removed by treatment with highly alkaline solutions. It is also known that lignin may be removed selectively by oxidizing agents. It is further known that alternate treatment with alkaline solutions and an oxidizing agent will produce very rapid lignin degradation. In cooling towers, the pH of the circulating water is not usually high enough to qualify as a highly alkaline solution. Chlorine is the principal oxidizing agent present, and is not usually present in sufficient concentration to produce rapid lignin removal.

However, in cooling tower operation, extremely long periods of time are involved. The reactions need not be rapid to produce an end result. It has been observed that this type of deterioration becomes particularly severe if circulating waters with high pH are used, in which cases the surface concentrations of alkaline materials are likely to be high.

Further support to the hypothesis that this type of deterioration is primarily the result of chemical action is furnished by reports of tower operators to the effect that this condition can be produced very rapidly by increasing chlorine residuals, indicating that careful control is necessary.

It has been further observed that the condition becomes particularly severe if chlorine residuals above 1 ppm are maintained in waters with a high pH. The fact that the toxic extractives nor-

mally in redwood that render it resistant to decay are reduced by this type of degradation should be stressed, since it has a bearing on the next type of deterioration to be discussed.

Chemical deterioration is closely related to the composition of the water, and the probable incidence of attack may be predicted from the water analysis. Field observations indicate that this type of deterioration is apparently highest in intensity in the parts of the tower which are subjected to flowing water and in those air inlet areas in which drops of water splashing out onto louvers evaporate completely to a dry condition, mechanically disintegrating the wood as crystals form beneath the surface.

Biological surface attack produces a crumbly surface on the wood, not unlike the residue of the brown rots, and it is probably preceded by chemical degradation. It is usually recognized by the finely divided crumbly texture of the wood.

Color alone cannot be used as a criterion for classification since certain water contaminants, such as oil, will produce the brown color. The texture of the surface and brashness of the wood should be considered.

A chemical analysis of this type of deterioration shows that cellulose has been removed selectively. The extractive content has also been reduced to approximately the same level found in chemical surface attack.

This type of attack could not be positively qualified as solely chemical in effect since a study of numerous water analyses failed to show any chemical conditions which would remove cellulose selectively.

Samples of the brash lumber which exhibited this type of deterioration were taken from several towers in one plant and cultured, the cultures purified and studied. A number of bacteria were isolated as well as fungi.

All were checked for their ability to utilize cellulose as their sole source of carbon. None of the bacteria were able to do so, but a number of the fungi showed that they could take their carbon from cellulose. These were then transplanted to redwood, and a considerable number showed that they could live, using redwood as their sole source of carbon.

Since no chemicals, which might remove cellulose selectively, were known to be present, and since fungi were found to be present which could attack redwood, it is concluded that this type of deterioration represents the end result of fungal action, although the detailed mechanism involved or the specific organisms principally responsible have not yet been established.

The attack may result in a reduction in size or it may produce a porous, corky surface. Several characteristics may be used to differentiate between chemical and biological attack in the flooded portions of a tower with a fair degree of accuracy, but mycological examination is necessary to make a positive distinction between the two.

The micro-organisms usually penetrate the wood and do some damage throughout the piece. This results in a reduction in structural strength, producing a brittle condition referred to in wood technology as brashness.

This condition may be rather easily identified by breaking a piece of wood and noting the fracture. Normal wood breaks with a series of fractures, accompanied by splitting along the grain. The splitting disappears with brashness and the failure becomes a single fracture squarely across the grain.

Internal biological attack has been applied to the deterioration occurring within the wood. It is observed as occurring under the surface, often leaving a sound shell of wood.

The degraded wood is normally light brown in color, and the wood crumbles to a brown powder on handling. In the early stages, the affected wood is often delaminated, the laminae corresponding to the annual rings.

Microscopic examination shows that the summerwood was attacked first and was selectively degraded, leaving the springwood in integral laminates.

Chemical analysis showed that cellulose had been selectively removed. In those towers in which this type of degradation exists, the possibility that chemical action was the sole cause of this form of degradation was considered and laid aside since no chemicals were generally known to be present which could selectively remove cellulose under these conditions.

Fungi were isolated from specimens showing this type of degradation. The probability of increase in the intensity of attack has been found to increase with increases in pH or chlorine residuals, which conditions are known to remove, or reduce, the natural toxic extractives in the wood.

It is inferred from this correlation that unfavorable combinations of pH and chlorine react rapidly with extractives near the surface of the wood and lower the concentration of extractives near the surface. An extractive gradient is thereby established which gradually lowers the extractive content within the piece. The resulting internal conditions apparently reach a condition not unfavorable to the development of fungi, even though the same fungi are not able to develop on the surface due to unfavorable conditions, such as excessive moisture, chlorine or high pH.

It is concluded that this form of degradation represents the end result of fungal action, with chemical action as a precursor.

In the towers under consideration in this report, this form of deterioration was found in greatest intensity in the non-flooded portions of the tower on the leaving-air side of the water distribution system.

Annual inspections of the 103 operating towers in the Gulf Coast area are being made by Cooling Tower Institute field engineers. Each observation is reported to the CTI Sub-Committee on Wood Maintenance for tabulation and analysis.

Statistical analyses which were completed on the 1951 data comprised the basis for the foregoing article. A composite report is planned when results of the 1952 and 1953 surveys have been correlated.

Inspection data included on the annual report forms comprise the following:

Tower owner, plant location, tower manufacturer, type, model, number of cells, cell arrangement, type of lumber, and age.

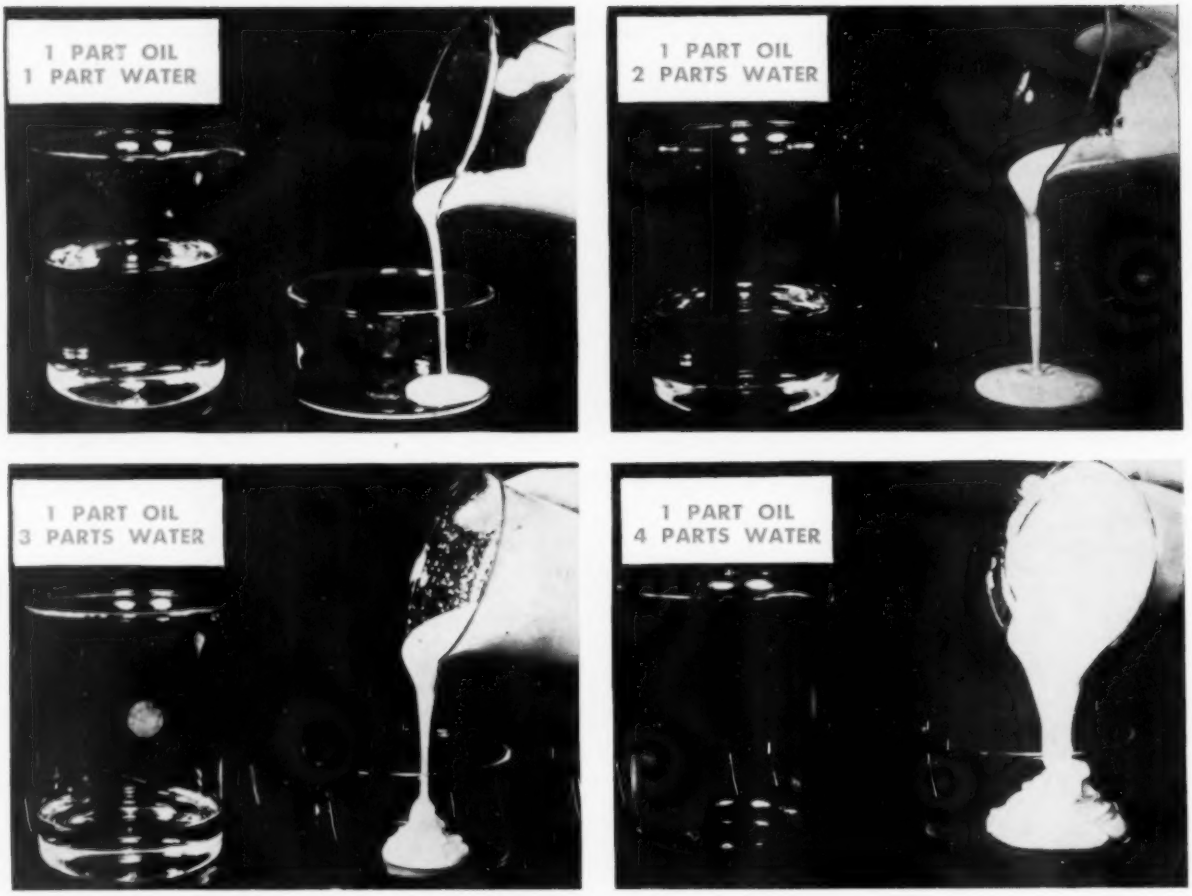
Design and operating performance data; water pH average, maximum, minimum, and method of control; type of algaecide, whether injected continuously or intermittently, and other pertinent data.

Wood inspection, with details on condition at various points such as drift eliminators, louvers, inside and outside casings, filling, frame, and any other. A report is also made on replacements and repairs and date they were made.

Annual inspections are also being made of some treated wood test panels installed in 20 of the 103 cooling towers. In addition, 10 companies are supplementing the annual inspection of these panels by reporting quarterly water analyses for the towers in which the panels have been installed.

Each of these test panels consists of nine pieces of wood of four different species, each treated differently or untreated for control. Redwood, fir, pine, and cedar are under observation, with a total of 360 pieces (in the nine-piece panels) distributed throughout each of the 20 test towers.

Continuing studies may qualify the correlation between water composition and the frequency and intensity of the various forms of chemical and biological attack.



CONTROLLING VISCOSITY by varying ratio of oil and water is one of . . .

10 Tips for Making Better Emulsions

HERE are ten practical suggestions that will help the emulsion formulator get better results in compounding cutting oils and similar petroleum-base emulsions. They have been worked out by chemists with the Atlas Powder Co. after extensive investigation of emulsions and emulsifiers.

1

Controlling emulsion viscosity

Viscosity can be controlled in several ways. One way to raise it—by increasing the proportion of the internal phase—is illustrated in the four photographs at the top of this page.

Viscosity goes up as more water is added to a mixture of oil and emulsifier to form a water-in-oil (W/O) emulsion. In picture A, the W/O ratio is 1/1; in B it's 2/1; in C, 3/1; and in D, 4/1. As this water phase was increased, mechanical crowding of the growing number of water particles dispersed in the oil brought on higher and higher viscosity.

The same phenomenon could happen in an oil-in-water (O/W) emulsions. When oil is added to a water-emulsifier mixture it is increased crowding of the dispersed oil phase that causes a rise in viscosity.

Viscosity can also be increased by adding thickeners to the external phase, by including such higher melting point components as solid fatty acids and solid fatty alcohols in the internal phase, or by incorporating air as a third phase.

On the other hand, a decrease in viscosity may be desired. This can be accomplished by increasing the proportion of the external phase, or by increasing its viscosity. Sometimes, the addition of a hydrophilic surface active agent will promote a decrease in viscosity.

2

Use of emulsifier blends

Proper balance of the oil-loving and water-loving groups within the emulsifier molecule must be obtained to achieve emulsion stability. Although single emulsifiers are sometimes used, blends of emulsifiers can frequently supply the proper ratio more efficiently. Representative of emulsifier types most commonly used in blends are sorbitan fatty acid esters combined with their polyoxyethylene derivatives. The former products tend to be oil soluble, but dispersible

or insoluble in water, while the latter are soluble or dispersible in water.

In working with such blends, it is suggested that a method of selection be employed which consists of matching the emulsifier with the job it is required to do in the emulsion.

3

Adding emulsifiers to formula

When using a combination of emulsifiers at fairly high concentrations to get oil-in-water emulsions, best results are usually obtained if the emulsifier is dispersed in the oil phase and the water is slowly added to the mixture to the inversion point (W/O to O/W), and then is added more rapidly.

When very little emulsifier is used, it is best to add the oil and emulsifier to the water in a "pre-mix" and then to homogenize the coarse emulsion.

4

Temperature of oil, aqueous phases

The temperature of the oil phase and the aqueous phase should be approximately the same at the time of emulsification. To allow for cooling during addition, it is best to have the phase to be added about two degrees warmer than the other phase. If waxes are a part of the oil phase, the temperature should be at least 10° F. higher than the melting point of the wax.

5

Melting oil phase ingredients

When the ingredients of the oil phase must be melted, heating of the batch should be done without local overheating. A good practice is to use jacketed equipment.

6

Making O/W soap type emulsions

If the emulsion is to be the oil-in-water soap type with the soap formed "in situ," the best method is to add the alkali in solution to the melted oil phase containing the fatty acid to be saponified. In this manner the soap content or emulsifier content is increased gradually as the water is added, and a smoother emulsion will be the result.

7

Making W/O emulsions

It is best to add water to the mixture of oil and emulsifier, and then to homogenize the emulsion. Homogenization may not be necessary if a small amount of a hydrophilic emulsifier is used in addition to the strong water-in-oil emulsifier.

8

Avoiding air entrapment in emulsion

If air is trapped in the emulsion, stability may be greatly reduced because the emulsifier tends to migrate to the liquid-air interface instead of remaining at the oil-water interface.

The most common cause of the incorporation of unwanted air in an emulsion is vortex formation, which can be easily seen on the surface of an emulsion during preparation. The vortex can be easily eliminated by providing an inexpensive metal or wood baffle in the mixing vessel.

9

Use of preservatives, anti-oxidants

Preservatives and anti-oxidants should be added to emulsion-type products because sterile conditions cannot usually be maintained throughout manufacture and use. When vegetable oils are used, the use of an anti-oxidant is suggested. An anti-oxidant or preservative manufacturer should be asked for recommendations for specific problems.

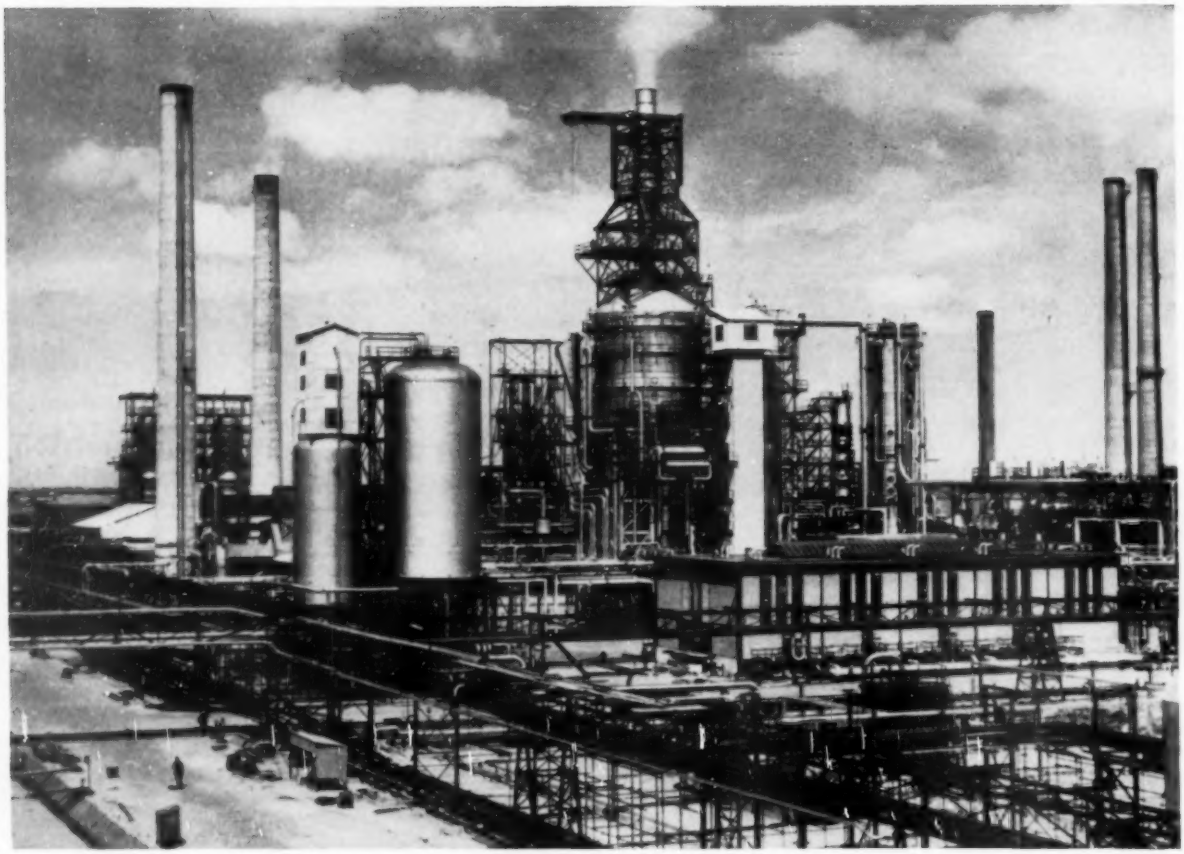
10

Source of formulation ingredients

Avoid variations in the source of raw materials. Even seemingly unimportant changes can easily upset the stability or another important characteristic of an established formula. For instance, seasonal changes in local water supply, or changes in the source of supply of the ingredients or in preparation conditions can all have disappointing results to the formulator.

NEWS in VIEWS

OIL INSPECTION LABORATORY, part of new engineering and research facilities at the Sugar Creek, Mo., refinery of Standard Oil Co. (Indiana). Of brick construction, the building is air-conditioned throughout. A total of 35 research dept. personnel is housed on the first two floors of the new center, including the laboratory shown in this picture. Associated with the oil inspection lab is a separate room for running flash point tests. In addition to research people, there is a total of 40 more employes in the engineering department, as well as top refinery management personnel, housed at the new facilities.



FIRST CAT CRACKER IN EUROPE is this 29,250 b/d unit at Rotterdam

Pernis—Rotterdam

Europe's newest and largest refinery includes the first Fluid cat cracker on the Continent

By V. S. SWAMINATHAN
London, England

THE recent completion of the fourth crude distillation unit at the Pernis, Rotterdam, refinery of Royal Dutch-Shell, with a capacity of 65,000 b/d—has lifted this refinery to top position in Europe. The second largest—Esso's refinery near Fawley in England—has a throughput of close to 130,000 b/d, while Pernis now is rated at 180,000 b/d.

Contributions to economic recovery in Europe by the petroleum processing industries, already of considerable magnitude, have been further enhanced by this 43% expansion in capacity at Pernis. In 1952, prior to this final phase of a long-range expansion program at that plant, annual crude runs in Europe (including England) amounted to 155,000,000 bbl. The Pernis crude runs for that same year were 28% of the total, or about 44,000,000 bbl.

Erected at a cost of $5,600,000, the newest crude still at Pernis, designed by Shell, went on stream last October, having involved just over a year of construction. Total capital outlay for the complete refinery expansion is estimated at over $70,000,000.

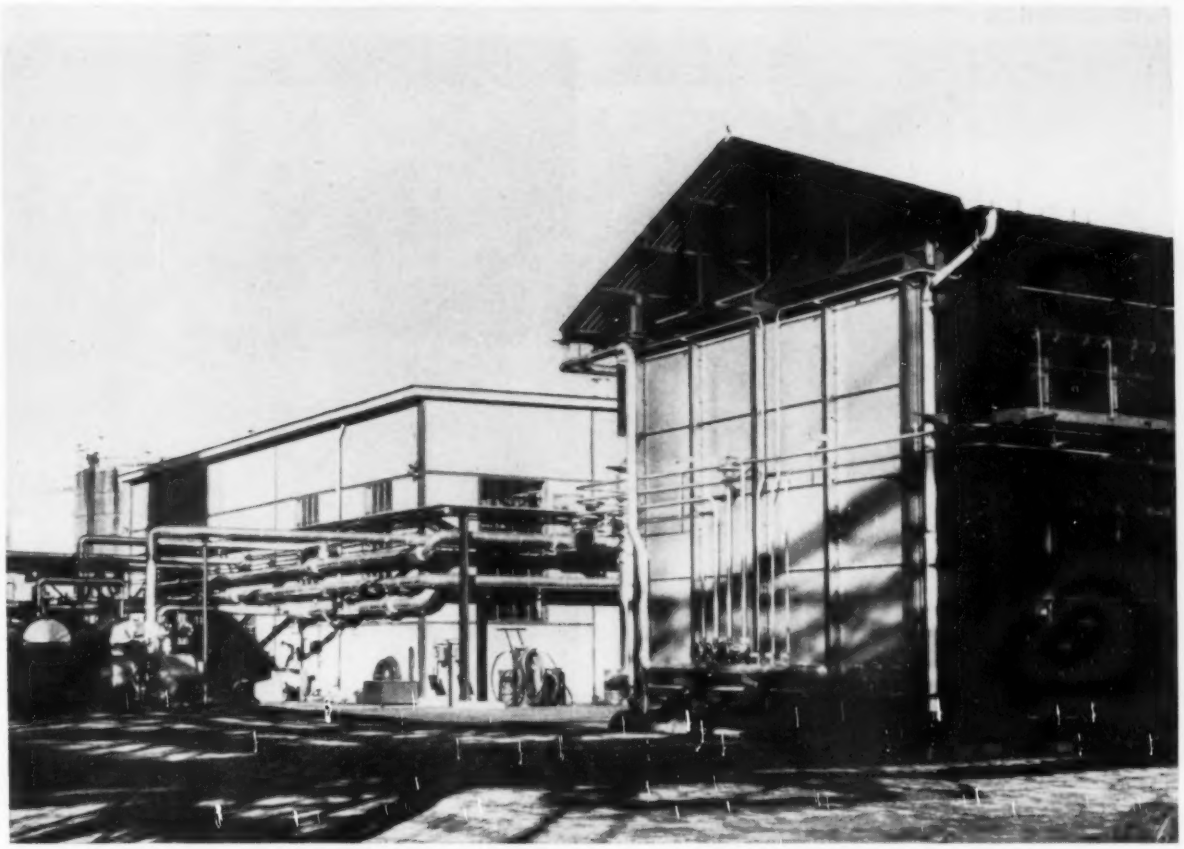
Initial construction of the refinery itself, on its present site on the south bank of the Nieuwe Waterweg, was started by the Royal Dutch-Shell group in 1934. At that time the plant included crude distillation, bitumen distillation with atmospheric and vacuum sections, a thermal cracking unit, gas processing, polymerization, and hydrogenation. That building program was completed in 1937 and two years later crude capacity was 20,000 b/d.

During the second world war, the refinery was at a standstill, and it suffered severe damage. Following that emergency, an extensive and active program of rehabilitation and expansion was established.

Today the Pernis refinery, in addition to the four distillation units, embraces such facilities as thermal cracking and reforming, a Fluid catalytic cracking unit (first in Europe), polymerization, lube oil and bitumen units, and treating facilities.

Still under construction, and expected to be completed in 1954, are lube oil deasphalting and extraction units.

Petrochemicals also play a role in European expansion and are a part of the manufacturing activities at Pernis. There are three units for: 1) synthetic detergents, 2) polyvinyl chloride plastics, and 3) "Epikote" resins, for the paint and varnish industry. In addi-



ASPHALT BURNING SYSTEM at Rotterdam comprises these heaters

tion, elemental sulfur is being recovered, and plants are underway for producing chemical solvents and two new insecticides—dieldrin and aldrin.

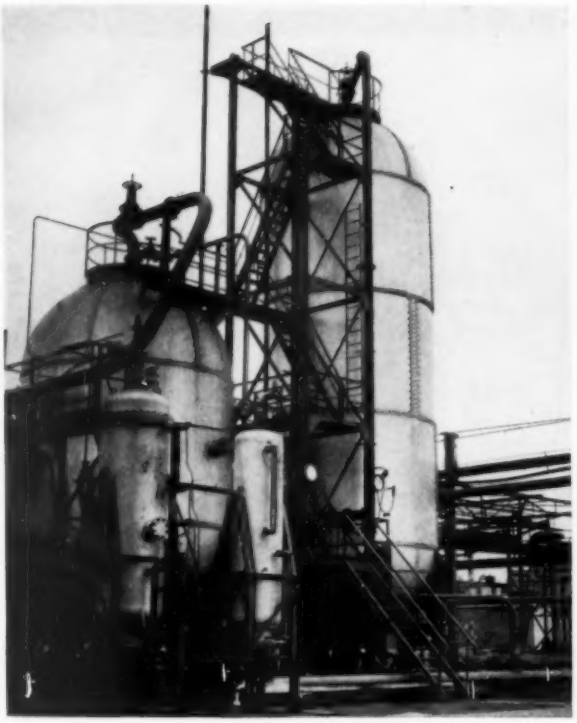
Total area at Pernis is 900 acres, of which 550 are in use for processing and related facilities. Its aggregate water front, including tank farms, covers 3½ miles. There are 19 docks for tankers, coastal tankers, and tank lighters. Seven tankers, including the latest 28,000-ton vessels, can berth at the same time.

Major straight-run products from the refinery are light and heavy gasoline, kerosine, light and heavy gas oil, and residual. Crude oil is now, to a major extent, coming from the Middle East, with some additional coming from the domestic Schoonebeck field. Besides the liquid products, propane and butane are separated from the crude still gases.

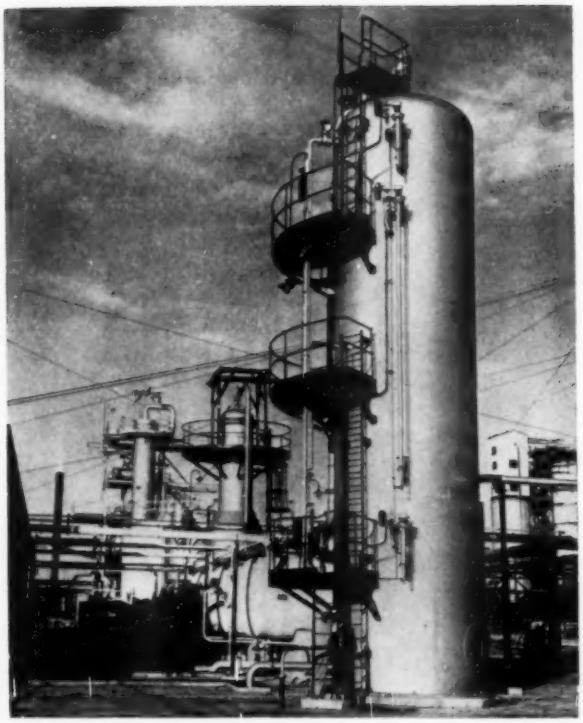
Further treatment of the residual takes two different routes. In one case, it serves as a feedstock for two of the four high-vacuum stills, waxy distillates being obtained and a new heavy residue left. This bottoms can be admixed to fuel oil, or delivered as an asphalt after additional processing.

The waxy distillates serve as a feed

CRUDE STILL, one of four similar units at the Dutch plant



PROPANE UNIT, one of the older installations at Pernis, put into operation after the war



CAUSTIC TREATER, another of the units installed as part of the current expansion program

ONE OF THE TANKER LOADING STATIONS at Rotterdam, showing pumphouse and piping manifold in foreground

stock for the Fluid catalytic cracking unit. Other waxy distillates are dewaxed in an MEK-benzene extraction plant. The wax obtained is cracked in the vapor phase in a thermal cracker designed especially for this purpose.

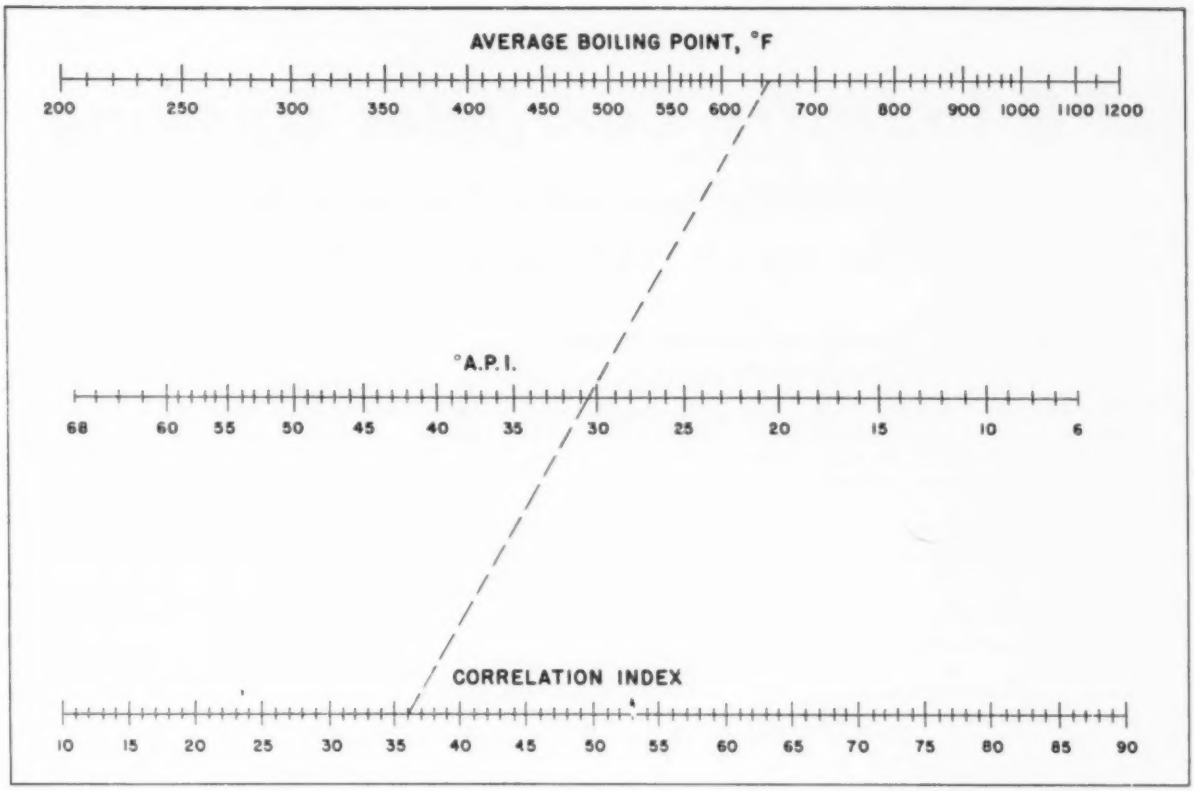
The second route takes the residual to a two-stage thermal cracking unit of 22,500 b/d capacity. In one stage, residual or heavy crude oils (which can also be used as charge stock) are converted to cracked gasoline and gases, with a liquid cracked residue being formed. In the other stage, cracking conditions are designed to yield coke as bottoms, and obtain maximum gasoline yield.

Thermal reforming at Pernis has a capacity of 90,000 b/d. Gases obtained during the various cracking processes are purified and split into butane and propane.

Sulfur is obtained from the hydrogen sulfide from these gas purification units by processing in a Claus kiln plant.

The Fluid unit, first to be erected in Europe, has a capacity of 29,250 b/d, about half the size of the Fluid unit at Fawley. It was built at a cost of $22,400,000, including auxiliaries. Gases from the Fluid unit are supplied to the adjoining municipalities of Rotterdam and The Hague to supplement their supplies of gas for domestic use. A pipeline from the refinery at Pernis to Rotterdam was completed in 1952.

V. S. Swaminathan, author of the preceding article, is a consulting engineer and technical writer of London, England. He has made frequent previous contributions to American technical and industrial magazines.



HERE'S A HANDY

Short Cut to Correlation Index

By K. A. HARPER
Phillips Petroleum Co.*

As a means for characterizing crude petroleum stocks with respect to aromaticity, the Bureau of Mines' Correlation Index (C. I.) seems to be gaining favor rapidly.

Unfortunately computation of Correlation Index is somewhat unhandy when the equation is used. Tables can be developed from the equation, but a more readily usable technique and one that has proved a valuable time saver is the nomograph shown above.

The equation for C. I. is as follows:

$$C.\ I. = 48460/°K\ (b.\ pt.) + (437.7 \times sp.\ gr.) - 456.8$$

This can also be written:

$$C.\ I. = 87552/°R + 67029/(131.5 + °API) - 456.8$$

The example shown by dotted line in the above nomograph is for 650° F. boiling point and 30.5° API, giving a C. I. of 36.0. The exact value is 35.8.

This is typical of the nomograph's accuracy. Since 3° error in boiling point or 0.1° API would give the same error in C. I., the nomograph is considered satisfactory.

It also has been common practice to simplify calculations by using the 50% point in place of average boiling point. No attempt has been made to determine the loss of accuracy due to this short cut. However, if this is done continuously, the trends should be consistent.

The Correlation Index is a number whose magnitude indicates certain characteristics of a crude oil fraction.(1)

A study of possible relationships between boiling points and specific gravities of hydrocarbons showed that, if the reciprocal of the b. pt. in ° Kelvin were plotted against the sp. gr. for the normal paraffin hydrocarbons, a linear relationship resulted. When similar data for other hydrocarbons were plotted on the same basis they did not fall on a single line, but conformed to zones or groups.

As a group, the iso-paraffins are found adjacent and parallel to the normal paraffins. At higher densities there is a zone representing the naphthenes: at still higher densities are the values for the aromatics.

The position of the data on the chart so developed indicated it would be possible to obtain an approximation of the composition of the material having a certain boiling point by drawing lines parallel with the one for the normal paraffins, and using the intercept of these lines on the temperature axis as an identifying number.

To further simplify the system, the intercept for the normal paraffin line was arbitrarily given zero as the index number, and the intercept for the line through benzene an index number of 100. The interval between these two lines included virtually all hydrocarbons usually found in the analyses of crude oil.

The index system can be applied to the Hempel analysis data; because each fraction has an average boiling point and an average specific gravity. Therefore, the calculation of this index for each fraction provides an indication of the type of material present.

* Mr. Harper is supervising process engineer, refining department, Phillips Petroleum Co., Bartlesville, Okla., and inventor of the nomograph he describes in this article.

(1) "Refining Properties of New Crudes," Part 1 of a Series; by N. A. C. Smith, H. M. Smith, and C. M. McKinney, PETROLEUM PROCESSING, June, 1950, pp. 609-614.

LPG Industry Continues Upswing

Chemical and motor fuel uses show big gains as overall 1953 sales rise 10% above 1952

By GEORGE R. BENZ and PAUL W. TUCKER
Phillips Petroleum Co.*

CHEMICAL uses registered the largest single category increase—by a gain of 16.6%—among the various major market uses for liquefied petroleum gas during the past year.

Overall sales of LPG approached a new volume milestone in 1953, with a healthy gain over 1952 of nearly 10%. And the outlook is for greater emphasis on sales backed up by increased LPG production and increased transportation facilities.

Total sales in 1953 are estimated to be 4,920,000,000 gals., an increase of almost 443,000,000 gals. and nearly double the gallonage increase registered during the preceding year. In addition to the big gain in chemical use, other highlights are as follows:

—Domestic and motor fuel use is estimated up over 295,000,000 gals., or 11.2%.

—Industrial and miscellaneous uses are down by nearly 3%.

—Gas manufacturing or utility use dropped 5%.

—Use in the manufacture of synthetic rubber components (included for the first time in this report) gained 7.5%.

Chemical Manufacture — Sales of LPG as a raw material for the manufacture of chemicals and chemical intermediates rose sharply, after a moderate increase the previous year, passing the one billion gal. mark. The estimated sales were 1,016,000,000 gals., representing an increase of 16.6% over 1952.

Many factors combined to bring about this accelerated increase. Several large plants which began operations during late 1952 were in operation all year. Others were started up early in 1953, and operated most of the year. Higher refinery runs of crude oil, plus deeper cracking of the medium and heavier fractions, resulted in an increased supply of refinery gases containing LPG. Demand for petrochemicals remained strong during the year, and numerous compounds became available for the first time in tank car quantities.

It has been estimated that 25 wt.-% of all chemicals produced in the United States during 1952 came from petroleum and natural gas sources, including LPG, and that this percentage will increase to 50% by 1965.

The use of both methane and ethane as a base for petrochemicals is increasing rapidly, and LPG will face increasing competition, especially from ethane, in this expanding market. Polyethylene is probably the fastest growing of all the petrochemicals, and ethylene required for its manufacture can be produced by cracking either ethane or LPG.

Domestic and Motor Fuel—Estimated sales of LPG for domestic and internal combustion engine fuel use in 1953 reached 2,932,000,000 gals. This is a 11.2% increase over 1952 and represents a gallonage increase of nearly 300,000,000 gals.

House heating continues to increase, with more people in central and even northern areas discovering the comfort and convenience this fuel brings. The increase in bulk consumer installations and in farm or agricultural applications continued unabated throughout the year.

Diversification of farm uses, including tractor fuel, stock tank heating, brooding, flame weeding, milk house use, and stationary engines, as well as use in the farm home, indicates increasing volume per installation as distributors sell the all-purpose advantages of LPG.

During 1953 an estimated 450,000 ranges were shipped for use with LPG. This is an increase of 2% over the number shipped last year. While the ratio of gas range sales to electric range sales dropped from almost 2 to 1 to nearly 1.5 to 1, the water heater sales presented just the reverse picture.

Automatic LPG water heater sales are estimated to be about 285,000 units. The LPG fired clothes dryer is proving to be very popular. Shipments of floor, space and wall type furnaces numbered over 400,000 units and represents about 20% of the total production of this type of gas-fired appliances. It is particularly interesting to note the active and increasing interest in LPG as fuel for the warm air furnace. It is estimated that 7.5% of the warm air furnaces were for LPG. A noticeable percent of the conversion burners for warm air furnaces were for LPG.

While it is extremely difficult to "pin-point" the amount of LPG used as engine fuel, it is conservatively estimated that this use alone required nearly 500,000,000 gals. in 1953, or almost 10% of the total sales. Spot surveys indicate that the consumption of LPG as internal combustion engine fuel in certain sections of the south and southwest is as high as 50% of the total LPG sales.

A recent survey indicates that about 2,000 buses will be operating on LPG by the end of 1953. One more major tractor manufacturer has announced the start of production of two of its tractor models factory-equipped to use it as fuel. A major truck manufacturer has extended his line of LPG fueled trucks to some of the smaller models. Another major gasoline carburetor entered the LPG carburetion field during the year. Two new LPG motor fuel dispensers were unveiled this year. A survey of taxi companies indicates a strong interest in use of LPG as a motor fuel. This is due principally to longer engine life, less maintenance and oil consumption, and better performance.

One of the most surprising developments during the year was the "sudden" development of interest in the use of LPG as motor fuel for industrial tractors and lift trucks. Several of the major manufacturers are now offering factory-equipped LPG models.

Industrial and Miscellaneous—The amount of LPG used for industrial and miscellaneous application is estimated to have dropped 2.9% during 1953. Actually, the drop in industrial use by itself is estimated to be down 5 or 6%, but the increase in miscellaneous uses tended to minimize the drop. The main reason for the reduction in industrial use is the extensions

* Mr. Benz is manager, engineering department, and Mr. Tucker is technical representative, engineering department, Phillips Petroleum Co., Bartlesville, Okla.

Annual Marketed Production of LPG

Year	Total Sales Gallons (in thou.)	Total Sales % Increase	Domestic & Motor Fuel[1]	% Increase	Industrial Misc.[2]	% Increase	Gas Mfg.	% Increase	Chemical Mfg.	% Increase	Rubber Components	% Increase
1922	223	....	Sale of liquefied petroleum gas confined primarily to bottled gas business prior to 1928									
1923	277	24.4										
1924	376	36.0										
1925	404	7.2										
1926	465	15.2										
1927	1,091	134.6										
1928	4,523	314.6	2,600	.....	400	.....	1,500	....				
1929	9,931	119.6	5,900	126.9	1,500	275.0	2,500	66.7				
1930	18,017	81.4	11,800	100.0	2,200	46.7	4,000	60.0				
1931	28,770	59.7	15,295	29.6	7,172	226.0	6,303	57.6				
1932	34,115	18.6	16,244	6.2	8,167	13.9	9,703	53.9				
1933	38,931	14.1	16,626	2.3	13,987	71.3	8,318	−14.3				
1934	56,427	44.9	17,681	6.3	32,448	132.0	6,298	−24.3				
1935	76,855	36.2	21,380	20.9	47,894	47.6	7,581	20.4				
1936	106,652	38.8	30,014	40.4	67,267	40.4	9,371	23.6				
1937	141,400	32.6	40,823	36.0	62,610	[3]	11,175	19.3	26,792	....		
1938	165,201	16.8	57,832	41.7	62,694	0.0	12,386	10.8	32,299	20.5		
1939	223,580	35.3	87,530	51.4	93,723	49.4	15,435	24.6	26,892	−16.7		
1940	313,456	40.2	134,018	53.1	124,482	32.8	20,285	31.4	34,671	29.0		
1941	462,852	47.7	220,722	64.7	172,669	68.6	25,255	24.5	44,206	27.5		
1942	585,440	26.5	303,857	37.6	197,179	14.2	31,366	24.2	53,038	20.0		
1943	675,233	15.3	344,962	13.6	237,396	20.4	37,519	19.6	55,356	4.4		
1944	898,071	33.0	445,617	29.2	254,590	7.3	45,879	22.3	151,985	175.0		
1945	1,067,979	19.0	533,262	19.7	256,577	0.8	53,849	17.4	224,291	47.5		
1946	1,410,370	32.1	758,466	42.2	253,745	− 1.1	86,660	61.0	311,499	38.8		
1947	2,209,797	42.4	1,150,538	51.7	274,125	8.0	169,332	95.4	414,267	33.0	201,535	....
1948	2,736,801	25.0	1,473,289	28.1	275,883	0.6	237,638	40.3	524,350	26.6	225,641	11.9
1949	2,836,599	5.9	1,627,550	10.5	247,103	−10.4	239,210	0.6	544,886	3.9	177,850	−21.1
1950	3,482,567	22.4	2,022,464	24.3	355,456	[4]	251,694	5.2	624,468	14.6	228,485	24.7
1951	4,227,275	18.4	2,456,804	21.6	269,408	[4]	281,692	11.9	844,507	35.2	374,864	64.5
1952	4,477,379	5.9	2,636,736	7.4	338,959	26.0	259,697	− 7.8	870,990	3.1	370,997	− 1.1
1953	4,920,000	9.9	2,932,000	11.2	326,000	− 2.9	247,000	− 5.0	1,016,000	16.6	399,000	7.5

[1] Household use plus other requirements by these customers such as irrigation pumping, tractor fuel, flame weeding, chicken brooding and similar uses. Included also is LPG sold by domestic distributors but used for industrial purposes. Included also, in 1951, 1952 and 1953 only, is LPG sold direct by producers and marketers solely for fueling internal combustion engines.

[2] For all years prior to 1951, include LPG sold for refueling internal combustion engines.

[3] Not comparable due to segregation of chemical manufacturing.

[4] Not comparable due to change in method of reporting LPG sold for refueling internal combustion engines.

LP-Gas used for manufacture of synthetic rubber components is included in this report for the first time this year.

REMARKS: In this table total sales for all years except 1953 were obtained from U. S. Bureau of Mines reports. Distribution for the years 1931 to 1952, inclusive, was obtained from the same source. All other volumes were estimated by the writers. The total sales volume includes all LPG (propane, butane and propane-butane mixtures) when sold as such. Until 1944 the sale of pentane when sold for any purpose other than motor fuel blending was included. Since then it has been excluded. It does not include butane when blended with heavier petroleum fractions for motor gasoline purposes. Intercompany sales transactions such as purchases of LPG by one company from other companies and resold as LPG have been eliminated in order to avoid duplication of sales figures.

of natural gas lines or increases made in the capacity of existing lines. The "standby" sales for industrial uses were not up to normal because the relatively mild weather made it unnecessary to operate the "standby" plants in many cases.

The railroads have expressed an active interest in LPG flame weeding for maintenance of right of ways because preliminary studies and trials indicate that flame weeding is cheaper than chemical treating. The railroads are also watching with more than average interest an experiment of the Union Pacific with an LPG fired turbine locomotive. Its clean burning characteristics are of particular note.

Utility Use—Sales of LPG for gas manufacturing purposes are estimated to be 247,000,000 gals.—a decrease of 5% compared to 1952. There are two factors accounting for this decrease: 1) the above average temperatures which prevailed over large segments of the country during the year, and 2) the change-over to natural gas.

The latter, of course, has been made possible by the completion of new gas transmission lines and the larger deliveries available in existing lines through addition of compressors and loops.

It is interesting to note, though, that many new large housing developments are being served by LPG through the mains simply because natural gas was not yet available in necessary quantities.

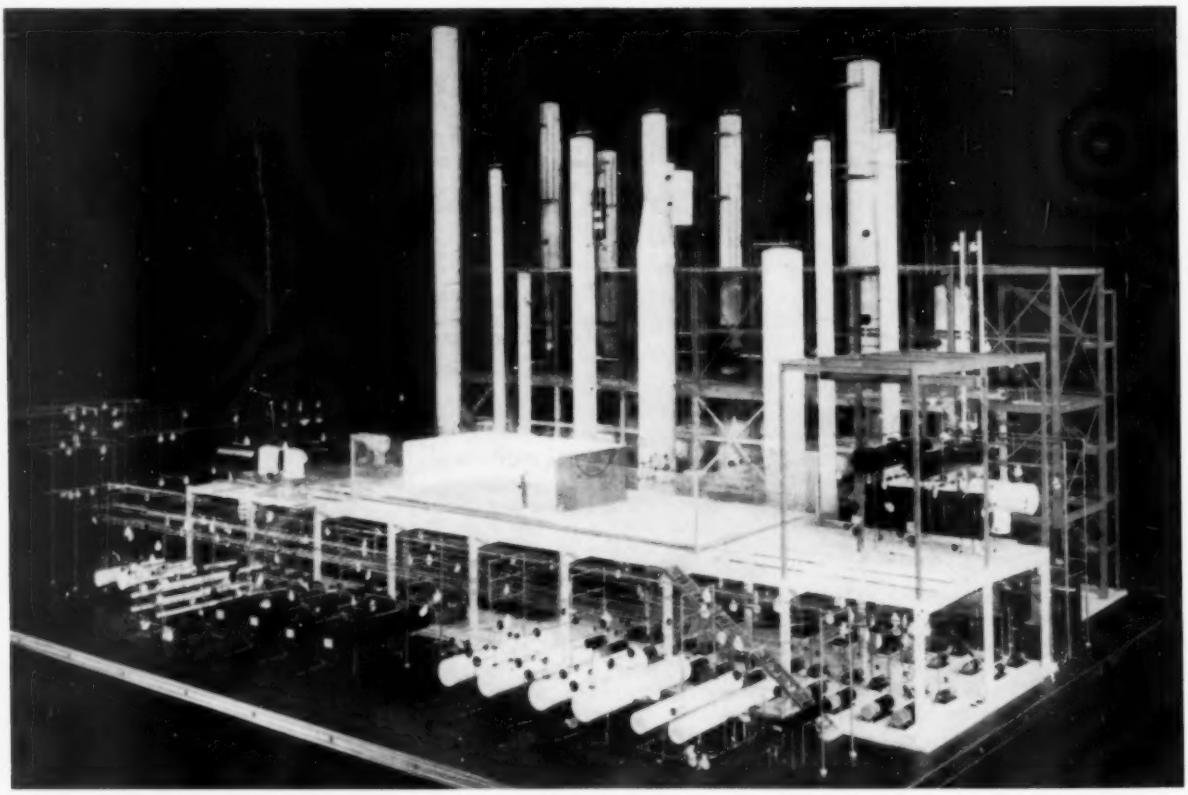
Rubber—The use of LPG as a raw material for the manufacture of synthetic rubber components increased an estimated 7.5% so that the total volume for this use approaches 400,000,000 gals. annually.

The Rubber Producing Facilities Disposal Commission has been entrusted by Congress with the disposition of the government-owned synthetic rubber facilities. This Commission has announced that it will receive bids between November 25, 1953 and May 27, 1954.

Supply—As might be expected, a sales increase of nearly 450,000,000 gals. requires new sources of production. The production segment of the industry kept pace with the addition of 15 plants during the year which have an estimated production capacity of 550,000,000 gals./yr.

Next year is is estimated that at least twelve new plants will come "on-stream" with more than 220,000,000 gals. capacity. This includes two new Canadian plants and a new plant in the Williston Basin in North Dakota.

It is interesting to note that the percentage of LPG from refineries continues its gradual decline. Five years ago 33.3% of LPG came from refineries, this year it will be about 28%.



VISUALIZATION IS THE KEY to the success of models for piping design. When you can see all the angles in front of you, you can figure out where to put the piping more efficiently in half the time

Models Can Cut Your Piping Costs

Save as much as 40% on design, 10% on installation with scaled replicas

By ***WILLIAM N. TROY***
Staff Writer*

HAVE you been groaning at the high piping design and installation costs for your new plants? There's a way in which you might be able to cut them considerably.

Recent developments in the making and use of engineering scale models to "test design" new plants before construction indicate that such models can now be used successfully for piping work. It is claimed that by using them:

Piping design costs may be reduced by as much as 30 to 40%.

Piping installation costs may be cut by about 5 to 10%.

These two factors alone mean that it is possible to shave as much as $400,000 off the cost of a new $10,000,000 processing plant.

These are figures that have been put together by Industrial Models, Inc., a firm in Wilmington, Del., which is one of the pioneers in the engineering scale model field and which has done a lot of development work in their use.

These models aren't toys. They are a relatively new but very distinct tool for the design engineer in the petroleum processing field. Built of wood, plastic and other easy-to-handle materials, they are usually constructed on a scale of ⅜ in. to the foot, and are accurate within 1 scale inch. They aren't complete down to the last minute detail (such as are the models of old sailing ships you admired years ago), but they show structures, process vessels, platforms, stairs, ladders and other essentials.

In the past, these models have been used mostly for checking the design of a plant itself—to locate major process equipment, to eliminate interferences and safety hazards, to assist in the training of new plant operators.

It is only recently that they have been applied to the piping work on new plants.

Getting back to those cost savings, here's how the engineers with Industrial Models explain them:

Suppose your total plant construction cost is estimated at $10,000,000. Of this amount, plant engineering cost will be roughly 7%, or $700,000. Of this, $250,000 is for piping drawings. A 30-40% reduction here could mean savings of $75,000-100,000.

Piping installation on such a project may run $3,000,000. If the use of a

* Bill Troy wrote this article, based on first-hand interviews with both model makers and users, when he was on the staff of PETROLEUM PROCESSING in Cleveland. He is still with McGraw-Hill, but is now assigned to the Cleveland News Bureau.

model can cut this figure by 5-10%, there's a further saving of $150,000-300,000.

That isn't the whole story. Building a piping model speeds up design procedure, helps move up the operation starting date. If your plant is geared to make, say, $15,000 daily before taxes and goes on-stream even a week ahead of schedule you can credit the model with saving you another $105,000.

Other savings can also be attributed to the model. Once design is approved, for example, sub-contractors for such items as piping insulation and painting can make bids based on what the plant actually will look like—not on sectional blue prints. When a sub-contractor can see exactly what space he'll have to work in and how much scaffolding he'll need, he can make cut-to-the-bone bids, without the usual "ignorance contingency" in his final estimate. One manufacturer reports that local contractors who were able to inspect a model submitted painting bids 15-20% lower than other contractors who did not see the model.

Proportionate cost of the piping model, in the theoretical estimates above, is estimated at approximately $20,000 — which means the buyer might save the price of the scaled replica more than 25 times over.

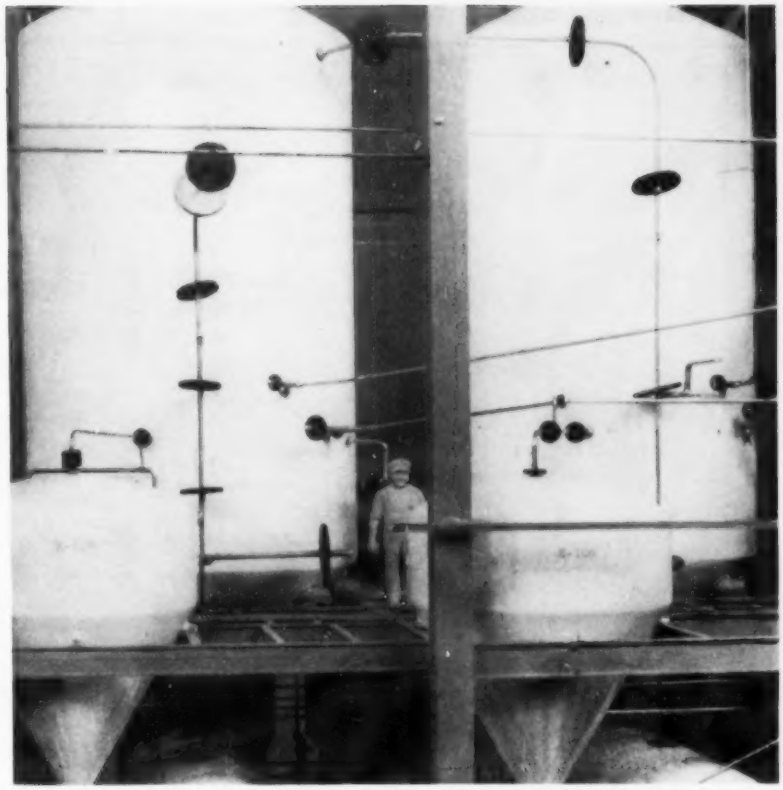
Bear in mind, of course, that these savings can't be attained on every job. They represent what experience has shown it is possible to achieve if the model is used to the fullest advantage.

That's the rosy picture painted by industrial model makers. Just how, and to what extent, can use of a scaled piping model bring this picture to "life"? Here is a typical procedure:

A preliminary scale model of the plant is built in the model maker's shop, working from arrangement drawings. No steel or equipment details are needed. This model includes girders of the building structure, if there is one, process equipment, and other auxiliaries such as flooring, ladders and the like. Standard scale for heavily piped models is ⅜ in. to the ft. Models built to a ¼-in. scale are too small for complex piping arrangements, and models built to a ½-in. or larger scale get too large for convenient use unless they are of a small, compact unit.

Some customers want every detail right down to the cages on the ladders and the plant nameplate. Some don't. So a list of "wanted" parts is checked over by the engineering firm before the model is begun.

Once this preliminary structural model is finished, it is usually shipped to the offices of the engineering firm handling the plant design. One or two model makers (who are general mechanical or design engineers with a flair for model making) accompany the unit. There, in consultation with the project engineer on the job, they begin working on the real meat of the job, the piping.



PIPING IS LAID OUT in the model with 1/16-in. brass rod. Black fiber discs are scaled to show true-scale outside diameter of the insulated pipe and can be moved along the rod to check clearances

Working from process flow diagrams or preliminary piping drawings, the model maker and the project engineer (or pipe designer) decide on the most economical layout to be used. This preliminary planning usually results in a lane or shadow system, in which all north-south piping is located at one elevation and all east-west piping at another elevation. Such a system allows for future expansion or modification without tearing out huge sections of standing equipment. It avoids, too, the "buckshot" appearance of many older refineries which have piping running at all levels and in all directions, with a great deal of wasted space.

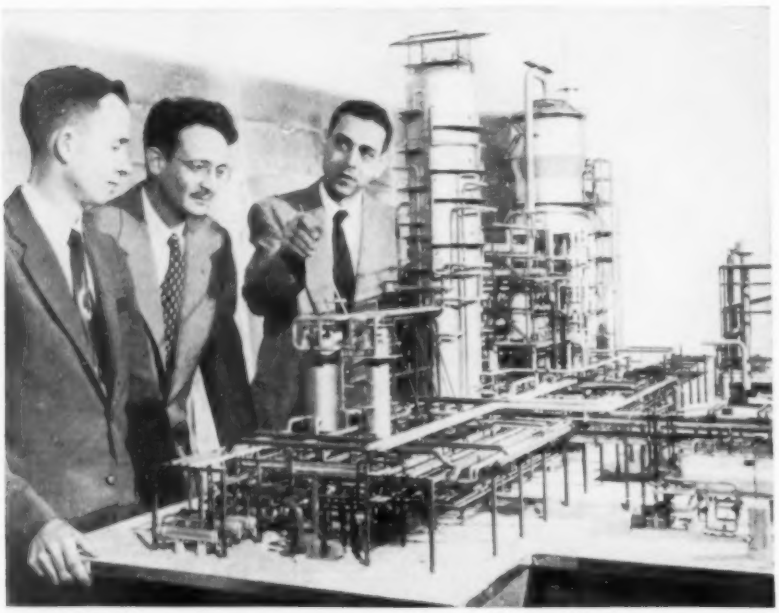
Brass rod, 1/16 in. in diameter and easily bent by hand, is used to indicate all piping. It is attached simply by inserting one end in a hole drilled in the proper vessel, or by soldering. Scaled fiber discs are placed on these rods to show the outside diameter of the final insulated piping. The discs are moveable, so clearances can be easily determined.

Use of this brass rod and fiber disc system gives great flexibility in design, making changes and revisions a simple matter.

To obtain the shortest, most direct route for key lines, the larger and more expensive piping is installed first. Once the pattern is set by these lines, it is a simple matter to place the smaller pipes, valves and miscellaneous parts. Instrument piping and electrical conduits usually are not included in the piping model, but reserved areas for these lines are indicated by placing plastic blocks in the positions where they will be located.

With all the piping installed, the model is finished and final piping drawings can be prepared. Or can they? At this point the model maker and project engineer stand back and take a look at their work. They begin to inspect it more closely. And in a matter of minutes they discover that the head room under this pipe aisle is too low, that maintenance men will have difficulty in reaching a certain fitting, that by changing the nozzle orientations on a few vessels hundreds of feet of piping can be saved.

Representatives of each of the other



THIS MONTH'S COVER PICTURE shows a true-scale model (¼ in./ft.) of one of the world's largest catalytic crackers—a 72,000 b/d unit now under construction at Shell Oil Co.'s refinery at Norco, La. H. H. Wanderman, builder of the model, points out some of its features to H. E. Henslee (left) of Foster Wheeler Corp., contractors, and H. L. Isham, Shell engineer

design groups concerned with the plant are called in, shown the model, and asked for suggestions. One engineer may point out, for instance, that a chain-operated valve can be easily eliminated by replacing it with a hand-operated valve at a higher level which is accessible from an adjacent platform. Another engineer might note that a particular run of piping leaves no space for pulling out heat exchanger tubes for cleaning. An instrument man may spot where a pressure gage should be 6 in. lower for easier inspection. A hundred and one problems that sometimes aren't noticed until the plant is half built are caught and easily corrected before one length of pipe is bent. And the changes effected so quickly on the scaled unit may eliminate hours of sifting through numerous drawings, and more hours spent carrying out the painstaking revisions.

There's the human element, too. A draftsman, faced with the task of rearranging piping routing will find "one" way of correcting the situation or another position for a valve. It may not be the shortest or most economical way. Model makers believe their method finds that route much more surely and quickly.

In essence, all intermediate drawings on piping are eliminated. Engineers can go from simple flow and process diagrams directly to a preliminary piping arrangement on the model, make revisions on the model, and then prepare final piping drawings from it. Revised drawings simply aren't necessary, except where a changed nozzle orientation or other equipment shifts must be marked on the original structural drawings.

True-scale piping may be installed on the model after the final piping layout has been set with the brass rods and fiber discs. Some model users have taken this further step with an eye to using the model for training operators and for publicity demonstrations.

The advantages of true-scale piping are twofold: 1) It gives a more realistic picture of the plant for training operators, and 2) it makes a handsomer and better looking model for display purposes. On the other hand, it increases the model cost by 15-30%—without enhancing its value for its primary function of piping design.

Many other advantages are claimed for piping models. One of them: Because of easier access and more built-in aids, maintenance costs can be greatly reduced through the years of the plant's operation. Another: Management can survey the model and make an accurate estimate of how many people it will take to run the plant and where they should be stationed. Just how much use models are getting in these latter phases of operation is a moot point, but Industrial Models says more and more of its customers are taking advantage of these marginal benefits.

Another point: Experienced draftsmen are hard to come by these days. Even a relatively inexperienced man can do a good job of final piping drawings from the model.

Some important limitations in the use of models must be recognized, as is true with any design tool. You can't, for instance, install piping directly from the model. Although accuracy is set at ±1 scale in., final drawings still have to be made.

Also, while model piping can be and frequently is color coded to show what type of materials will be carried, it is of no help in estimating stresses and strains. It is of assistance, on the other hand, in visualizing stress required configurations.

Several new developments now in the planning stage make modelers believe their product will have even more value in the future.

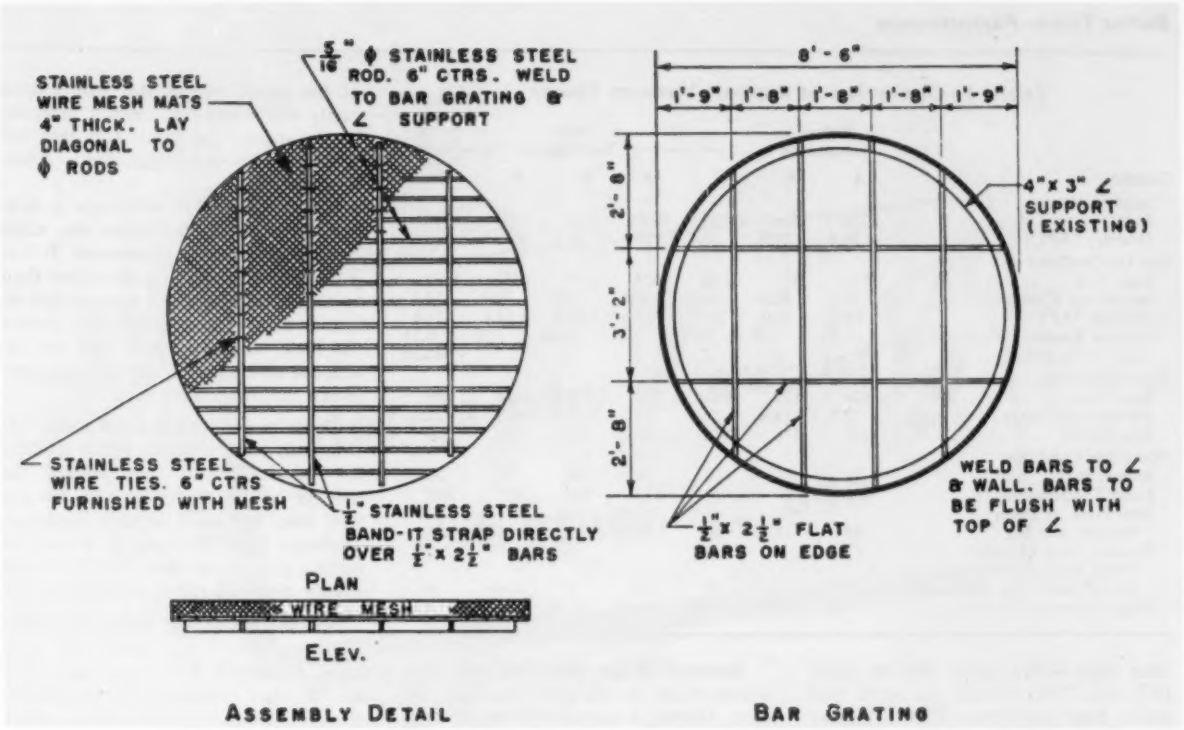
One idea is to build the entire model so that it will come apart in slices both horizontally and vertically. Photos taken at various elevations and sections can then be dimensioned by draftsmen, enlarged, and distributed in any quantity to various design groups —thus lessening the present problem of having only one model, which is frequently in demand by more than one group at the same time.

Another suggestion now being tested is to by-pass conventional piping drawings and go directly from the model to isometric drawings. Isometrics can be used for fabrication and erection, being supplemented in the latter application with a simple plan view of the headers.

The biggest argument of all in favor of a piping model, of course, is the fact that a three-dimensional model permits visualization of the problems involved.

Anyone can carry a mental "picture" of what the completed plant will look like. But often these "pictures" don't coincide, even among highly trained technical personnel. The result may be extra days, weeks or even months of work, and extra thousands of dollars spent trying to make sure that all essentials are coordinated.

In this day of skyrocketing material and installation costs, any design method which can trim your over-all budget by as much as 5% bears careful scrutiny.


STAINLESS STEEL WIRE MESH MATS 4" THICK. LAY DIAGONAL TO ϕ RODS
5/16" ϕ STAINLESS STEEL ROD. 6" CTRS. WELD TO BAR GRATING & ∠ SUPPORT
STAINLESS STEEL WIRE TIES. 6" CTRS FURNISHED WITH MESH
½" STAINLESS STEEL BAND-IT STRAP DIRECTLY OVER ½" x 2½" BARS
PLAN
WIRE MESH
ELEV.
ASSEMBLY DETAIL
8'-6"
1'-9"
1'-8"
1'-8"
1'-8"
1'-9"
2'-8"
3'-2"
2'-8"
4" x 3" ∠ SUPPORT (EXISTING)
WELD BARS TO ∠ & WALL. BARS TO BE FLUSH WITH TOP OF ∠
½" x 2½" FLAT BARS ON EDGE
BAR GRATING

HOW SINCLAIR INSTALLED the mesh section in an asphalt vacuum still

Wire Mesh Aids Tower Operation

AN installation of a stainless steel wire mesh section for entrainment control inside the asphalt vacuum tower at Sinclair Refining Co.'s Sinclair, Wyo., refinery has paid off in several ways:

1—Tower capacity has been increased substantially while still producing an equivalent or better quality gas oil and asphalt than was produced at lower feed rates prior to the installation.

2—Installation is relatively inexpensive, amounting to a total cost of a little over $800 for a tower running between 3000 and 4000 b/d.

3—Payout for the mesh, in terms of less carbon and less metal contamination in the gas oil overhead, has been estimated at 2½ to 3 years.

4—Maintenance of the mesh is simple. Sinclair estimates the life of the section under normal operating conditions to be between 2 and 3 years.

The installation was described by J. S. Corlew, technical assistant at the refinery, at the Casper, Wyo., meeting of the Western Petroleum Refiners' Association last fall. Considerable further details were brought out in a subsequent question-answer session.

The vacuum tower in which the mesh is installed is an 8½-ft. diameter, 48-ft. high, vessel with internal heat exchangers and gas oil cooler in the upper section. Feed enters tangentially while asphalt is drawn off directly at the bottom and gas oil overhead is drawn from the side of the tower after passing through the internal heat exchangers and cooler.

Originally, the tower had three splash trays and two bubble trays above the feed entry and four bubble trays below the entry. Modification of these internals before wire mesh installation resulted in improved operation of the still.

These changes consisted of: 1) removing the four bubble trays in the stripping section which were of little value since it was found that steam could not be used for stripping because of emulsion difficulties, 2) removing the three splash trays, 3) increasing the spacing between tower inlet and the first bubble tray, and 4) increasing the spacing between the bubble trays.

A single wire mesh section consisting of a 4-in. thick woven mat of Type 304 stainless steel wire was installed at a point 5 ft. below the top bubble tray, 11 ft., 8 in., below the gas oil outlet and 10 ft., 9 in. above the tower inlet.

The mat covered the entire cross sectional area except for the downcomer from the top bubble tray. The mat was supported by means of stainless steel rods, 5/16 in. in diameter spaced on 6-in. centers which in turn were supported by a bar grating of ½ x 2½-in. flat bar stock on edge, as illustrated in the drawing.

The mesh was cut in sections that would pass through the tower manway and were laid diagonally to the rod supports. Sections were then sewed together with stainless steel wire, and stainless steel ½-in. "Band-it" strap was laid on top of the mat and wired to the support rods to hold the mat in place. An angle support ring for one of the original splash tray locations was used in installing the mesh section.

Before and after operation data are shown in Table 1. Typical operation, before the mesh installation, at feed rates of 2750 and 3200 b/d, is shown in Columns A and B. Data for operation after the installation, at feed rates of 2750 to 4500 b/d are presented in Columns C, D, E, F, and G.

Reduction of carbon residue in the gas oil overhead at the 2750 b/d feed

Table 1—Operation of Asphalt Vacuum Tower

	Before Installation		After Installation				
Column	A	B	C	D	E	F	G
Charge Stock							
Rate, b/d	2750	3200	2750	3200	3500	4200	4500
Gravity, °API	20.4	20.7	20.4	20.5	20.1	20.4	20.4
Gas Oil Overhead							
Rate, b/d	2126	2573	2150	2458	2755	3322	3542
Percent on Charge	77.3	80.4	78.2	76.8	78.7	79.1	78.7
Gravity, °API	25.0	24.9	24.6	24.6	24.6	24.6	24.8
Carbon Residue, Wt.-%	0.26	0.30	0.14	0.25	0.20	0.29	0.53
Color NPA, Dilute	5	7	2	2	2	2	Black
Asphalt Bottoms							
Rate, b/d	624	627	600	742	745	878	959
Percent on Charge	22.7	19.6	21.8	23.2	21.3	20.9	21.3
Penetration	167	110	128	92	134	102	129
Operation Condition							
Reflux, b/d	72	70	30	28	28	28	28
Flash Temperature, °F.	690	700	690	690	690	695	695
Abs. Press. at Flash Section mm Hg	38	35	26	24	27	31	28
Pressure drop between Flash Section and top of tower mm Hg	2	2	3	4	4	4	4
Vapor Velocity, Ft./Sec.	7.7	10.2	11.3	14.0	13.9	14.7	17.1

rates was 46%: while that at 3200 b/d was 17%. Before the mesh was put in, feed rates above 3200 b/d were prohibitive because of the black color and high Conradson carbon of the overhead. Once the mesh was installed, feed rate was increased to 4200 b/d with no problems, while producing a 100-penetration asphalt and obtaining an 0.30 carbon residue on the gas oil overhead. (See Table 1.)

Allowable tower vapor velocities without severe entrainment were increased from about 10 fps. at 3200 b/d to about 15 fps. at 4200 b/d. A clean gas oil with an NPA dilute color of 2 was produced until the point of severe entrainment was reached at a feed rate of 4500 b/d while making 100-penetration asphalt. At this point, the gas oil went black and had a carbon residue of 0.53. Vapor velocity was about 17 fps.

Asphalt quality was improved by virtue of the better separation attained between the asphalt and the gas oil with the mesh installation. It was not necessary to sacrifice quality of one product to maintain quality of other.

Service of 981 days was obtained with the first mesh installation. Replacement was due to coke build-up on the mesh, which increased the pressure drop across the section to about 7 mm. Hg. at a feed rate of about 3200 b/d, and cut tower capacity.

Both carbon build-up and pressure drop increase gradually from about 2 mm. Hg. for initial operation to the 7 mm. Hg. when the mesh was replaced. As the pressure drop increases there is also a comparable decrease in the maximum allowable velocity without severe entrainment.

Burnout of the mesh has not been encountered in this particular installation. During a turnaround the section is wetted with water as a precautionary measure. The company now has a number of these installations in towers in several of its refineries, and it has had one instance of a burnout. The tower had been opened fairly hot, and after the steam was cut off the mesh pad took fire and was pretty thoroughly consumed.

The pad can be saved during a shutdown by keeping it wet. When the sulfur and carbon deposits are exposed to the air while they are still hot, spontaneous combustion may start.

Although company experience indicates a good service record for the mesh, it is policy to maintain a spare on hand for emergency replacement.

Installation of a replacement differs slightly from the original method. It consists of placing the 5/16-in. diameter rods, spaced on 6-in. centers on top of the mat. The rods are then welded to the shell of the tower and thus hold the mesh section in place without the use of the straps wired to the support rods. It is felt that both methods of installation are satisfactory from an operating standpoint, with the latter somewhat easier to install.

The mesh is operated without reflux, since the downcomer from the top bubble tray passes through the section and is sealed on the lower bubble tray. The downcomer seal was increased to about nine inches (weir height is 12 in.) in order to prevent by-passing of vapors in the event the wire mesh should become partially plugged with coke. Bubble caps were removed from the bottom tray because of the possibility of this tray coking easily with entrained asphalt removed by the mesh. The lower tray was left in place as a vapor distributor below the mesh.

There is no great advantage in having the cap-less tray below the mesh section for a vapor distributor. It was just easier to let it stay in rather than to take it out. Sinclair has one installation without a cap-less tray below the mesh and there has been no significant difference in performance between the two units.

Point in not refluxing the mesh section is that there would be no particular advantage in distributing the heavier boiling material from the top tray onto the mesh section, company engineers felt. Further, it would be quite a problem to distribute the liquid evenly over the mesh section.

Spacing above and below the mesh is not arbitrary, nor have any rules been developed governing this variable. Sinclair engineers simply allowed for ample disengaging space above and below the section. They have since used approximately the same spacing in other towers and obtained satisfactory performance. Most important factors are provision of maximum disengaging space between tower inlet and mesh and adequate spacing between mesh and top tray.

One explanation for the poorer performance with the conventional trays in the tower as compared with that when all trays but two were removed was this: Original tray spacing might have been too small, which resulted in a condition where foam was carried from one tray to the next. Without foaming, an increase in tray spacing would probably not help. But with frothing or foaming, it is felt that increased spacing is of definite advantage, even to the extent of getting rid of some of the trays.

As the good service record indicates, maintenance has been simple. Corrosion is not severe, although the tower feed contains 1.7 to 2.0% sulfur. The mesh is stainless steel. The tower is carbon steel with cast iron bubble trays and carbon steel heat exchangers.

No effort has been made to clean off the original mesh after it was fouled to the extent it had to be replaced. Cleaning methods would be difficult and costly. It was found in the replacement that a torch was the best method for cutting the material quickly and accurately. On the original installation, shears had been used but this was very time-consuming on the relatively thick mat—four inches.

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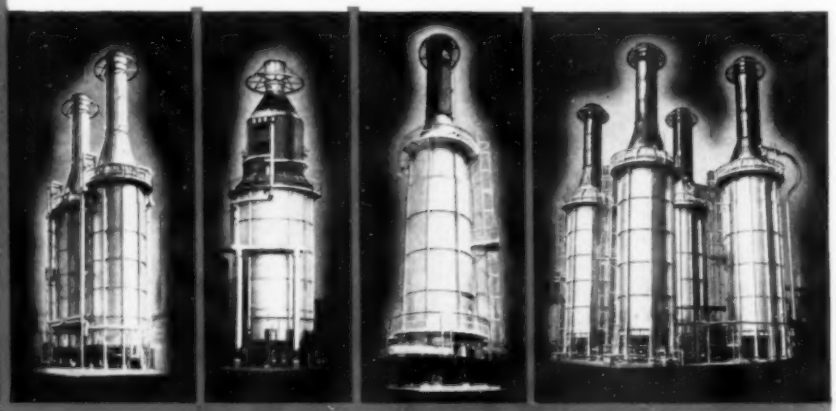

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PETROLEUM PROCESSING

FEBRUARY 1954

Petrochemical Processing Section

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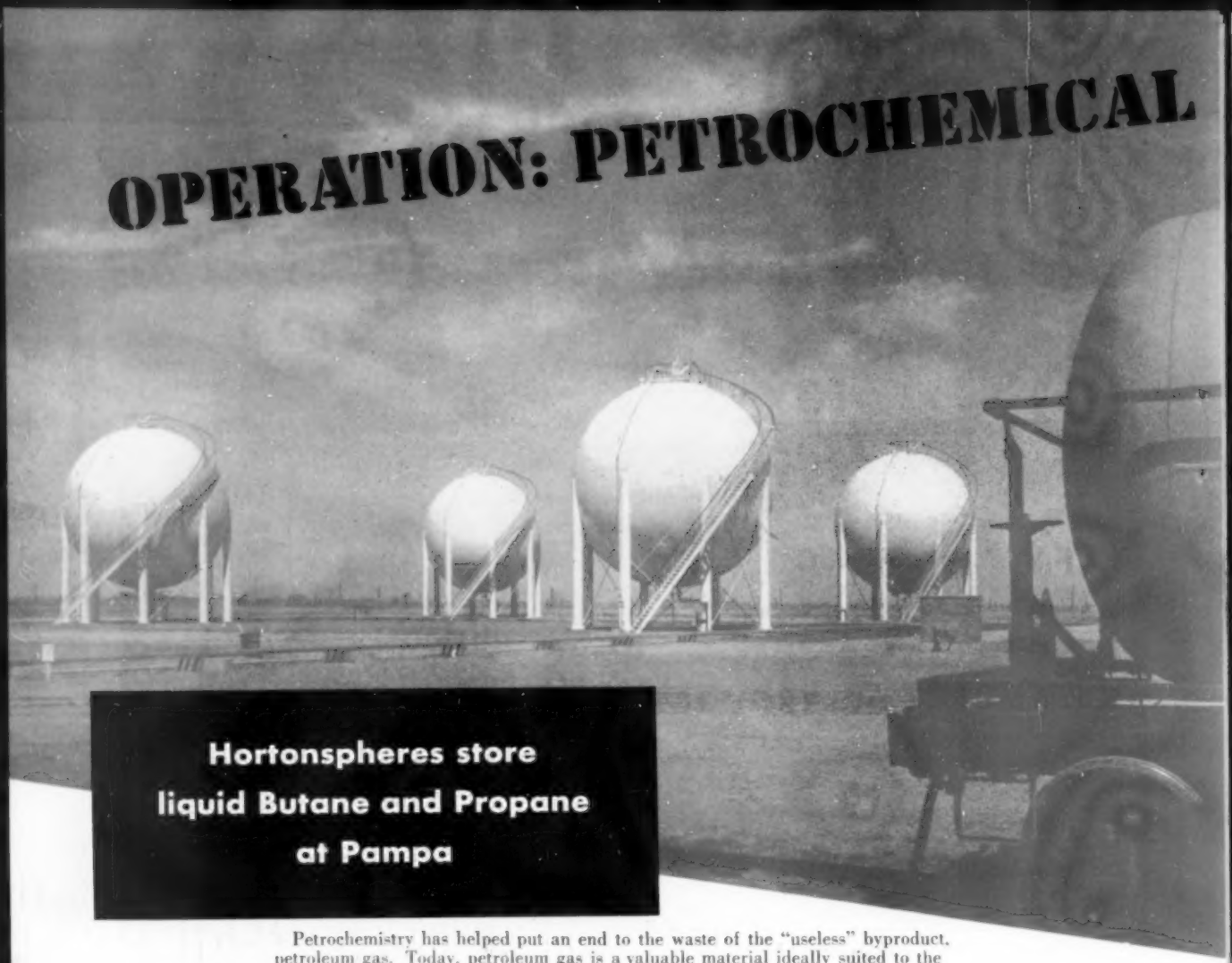

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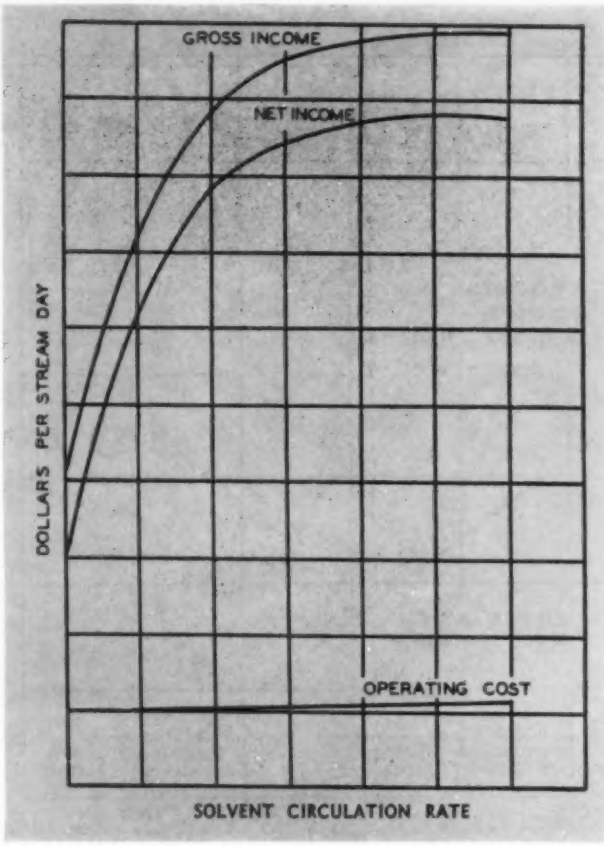

FIG. 1—Net income versus solvent circulation in Udex unit

Table 1—Material Balance and Recoveries for Udex Unit

Feed, b/d	1650
Feed, %-vol.:	
Benzene	7.6
Toluene	21.5
Xylene	21.0
C_9 aromatics	1.9
Non-aromatics	48.7
Raffinate, b/d	830
Raffinate, %-vol.:	
Benzene	0.1
Toluene	0.9
Xylene	2.0
C_9 aromatics	0.5
Non-aromatics	96.6
Products, b/d	
Benzene	125
Toluene	348
Xylene	330
C_9 aromatics	15
Recoveries, %:	
Benzene	99.5
Toluene	98.0
Xylene	95.0
C_9 aromatics	80.0

Note: solvent circulation rate is 780 bbl per day per sq. ft. of extractor total cross section, which occurs at the indicated maximum in net income, see Fig. 1

THE ECONOMICS OF
Making High Purity Aromatics

By W. K. JACKSON, C. K. CHADD, and D. M. KRAUSSE, Cosden Petroleum Corp.

REAGENT-GRADE aromatics by the tank-car have become a routine fact of normal commercial operation at Cosden Petroleum Corp.'s refinery at Big Spring, Texas, where a plant employing the Platformer-Udex process has been in operation since September, 1952, producing over 800 b/d of petroleum-derived products. Examples of purity include:

1—A car of Cosden toluene, scheduled for routine delivery as ordinary lacquer solvent, was requisitioned by the Government and diverted to a pharmaceutical manufacturer for use in the synthesis of cortisone.

2—Laboratory supply companies have used Cosden toluene and benzene for distribution as reagent chemicals meeting American Chemical Society specifications.

3—Big Spring-produced toluene is used by two large chemical companies in preparation of benzoic acid derivatives—for use in foods.

4—A federal arsenal has reported the toluene to be one of the best in its experience for nitration purposes.

The Udex solvent extraction process as used at Big Spring has been discussed previously from the standpoint of process design.[1, 2, 3] The purpose here is to describe the economic aspects of the operation, and also the new problems resulting from meeting purity requirements.

The extraction unit was designed for a feed rate of 1600 b/d of reformate from a UOP Platformer containing approximately 50% aromatics. It produces a concentrate of C_6, C_7, C_8, and some C_9 aromatics which is virtually free of non-aromatic impurities. This concentrate is then processed through clay towers to improve the acid-wash color and is separated continuously by three fractionators into benzene, toluene, xylene, and a small amount of C_9 aromatics.

Market value variations for the aromatics produced can be adjusted for economically with the process. Unusual design features are such as to permit independent adjustment of both recovery and product quality.

However, high purity is an inherent character-

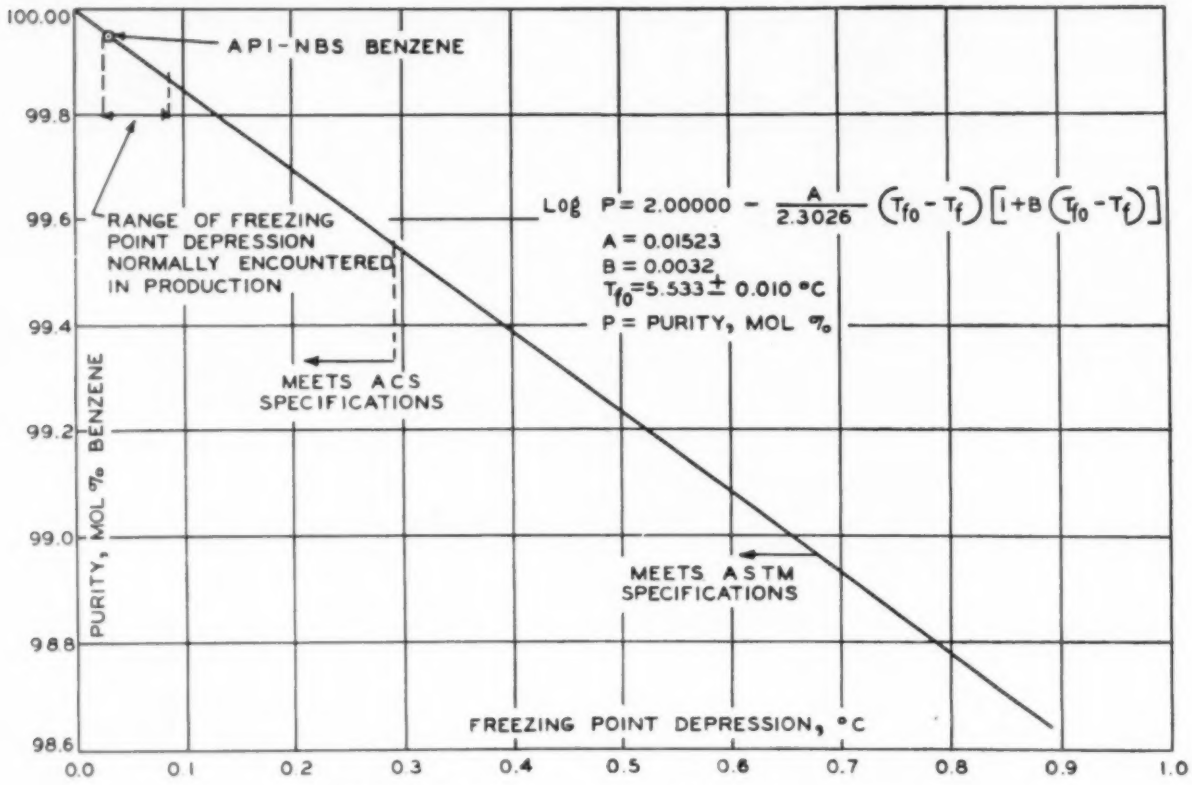

FIG. 2—Purity of benzene vs. freezing point depression

istic of the process, and only negligible savings can be effected by even a substantial reduction in quality. Therefore, with product quality fixed and with the charge rate and composition substantially constant over long periods, gross income, operating costs, and net income became unique functions of aromatics recovery, which in turn is determined by the solvent circulation rate.

This analysis is shown graphically in Fig. 1. The gross income curve is constructed from aromatics recovery and the incremental increase in value of the product due to the separation and purification. Over the practical range of recoveries desired, operating costs include those items affected by solvent circulation rate, such as utilities and chemicals.

The net income curve in Fig. 1 represents the difference between gross income and operational charges. At the indicated maximum in the net income curve—corresponding to a solvent rate of 780 b/d/sq. ft. of extractor total cross section—the corresponding material balance and recoveries around the unit are given in Table 1. A breakdown of operating costs is shown in Table 2. An increase in solvent rate at these high recoveries results in a raffinate containing less Cs aromatics, but no significant change in benzene and toluene content.

Table 2—Udex Operating Data

	per bbl. product
Utilities:	
Steam, 150 psig.;	
Udex	520
BTX fractionation	255
total	775
Power, kw.	0.59
Cooling water, gals. circulated	1420
Chemicals:	
Diethylene glycol, lb.	0.05
Clay, lb.	0.24
Maintenance, matl & labor, $	0.10
Operating labor, 1½ men/shift, $	0.10

This subject of aromatic purity has resulted in considerable analytical work to determine the type and amount of non-aromatic impurities. The quantity has been found to be less than 0.1%-wt. by concentrating the non-aromatics by the silica gel adsorption method followed by mass and ultra-violet spectrometer inspection of the concentrate. However, the precision becomes poor at these low concentrations.

Infra-red spectroscopic analysis by a double-beam technique has permitted precise comparison of the benzene with the American Petroleum Institute-National Bureau of Standards Standard Sample 210-b-25, the impurity of which is certified at 0.023 ± 0.015 mole-%. The results showed the paraffinic impurity in the Cosden benzene to exceed that of the standard by less than 0.01%-wt. A comparison of solidification points showed identical values.

Nitration-grade aromatics which also meet the rigid ACS specifications for reagent chemicals are easily produced. Table 3 gives the specifications for American Society for Testing Materials Nitration Grade and ACS Reagent Grade aromatics along with the inspections obtained on the benzene, toluene, and xylene produced from the Cosden unit.

Current production of benzene and toluene meets both sets of specifications, but for expediency the xylene is purposely made in such a manner as to fail boiling range and density requirements. The reasons for this are explained more fully in the following.

Benzene's freezing point specification gives a true index of purity. Both this and the distillation range specification have been subjected to considerable study. ASTM Methods D-1015 and D-1016[4] outline a procedure for the precise determination of purity based upon freezing point, and give

Table 3—Specification Tests on Aromatic Hydrocarbons

	Benzene		Toluene		Xylene	
	ASTM Nitration Grade spec	Product analysis	ASTM Nitration Grade spec	Product analysis	ASTM Nitration Grade spec	Product analysis
Specific gravity	0.8820-0.8860	0.8849	0.8690-0.8730	0.8724	0.8650-0.8700	0.8724
Color	water white	water white	water white	water white	water white	water white
Br. Index, mg br/100 gm	——[a]	10	——[a]	4	——[a]	9
Acid Wash Color:						
Acid phase	2 max.	0	2 max.	0+	6 max.	0+
Hydrocarbon phase	0	0	0	0	0	0+
Solidifying pt., anhyd., °C	4.85 min	5.49				
Acidity, mg NaOH/100 ml. samp.	no free acid	no free acid	no free acid	no free acid	no free acid	no free acid
Copper corrosion	——[b]	passes	——[b]	passes	——[b]	passes
H_2S and SO_2	none	passes	none	passes	none	passes
100 ml. distillation:						
Range, °C	1 max.[c]	0.5	1 max.[d]	1.0	3 max.[f]	2.6
Initial boiling pt.		79.8		110.2		139.0
5%		79.9		110.4		139.1
10%		80.0		110.4		139.2
20%		80.0		110.6		139.3
30%		80.0		110.6		139.6
40%		80.1		110.7		139.6
50%		80.1		110.8		139.8
60%		80.1		110.8		139.8
70%		80.1		110.9		140.0
80%		80.1		110.9		140.1
90%		80.2		111.0		140.4
95%		80.2		111.1		140.8
End point, °C		80.3		111.2		141.6
Recovery, %		99.0		99.0		99.0
Paraffin, %-vol.	——	——	1.5 max.	0.2[e]	4.0 max.	0.2[e]

[a] Proposed ASTM method, max. probably in range 25-50 Bromine Index.
[b] Strip shall not show irridescence nor gray or black deposit or discoloration.
[c] Including the temperature 80.1° C.
[d] Including the temperature 110.6° C.
[e] Below lower limit of test.
[f] Including the temp. 139.3° C. Initial b.p. not below 137.2° C. and dry pt. not more than 140.5° C.

	Benzene		Toluene		Xylene	
	ACS Reag. Chemical specs.	Product analysis	ACS Reag. Chemical specs.	Product analysis	ACS Reag. Chemical specs.	Product analysis
Boiling range, °C	——[a]	0.4	——[b]	0.8	——[c]	139-141
Freezing point, °C	5.20	5.50	——	——	——	——
Residue after evaporation, %	0.001 max.	0	0.001 max.	0.001	0.002 max.	0.002
Substance darkened by H_2SO_4	——[d]	passes	——[e]	passes	——[e]	passes
Thiophene	——[f]	passes	no spec.	——	no spec.	——
Sulfur, %-wt.	0.005 max.	0.0014[g]	0.003 max.	0.0014[g]	0.003 max.	0.0020[g]
Water	to pass	passes	to pass	passes	0.02% max.	passes

[a] Not more than 0.5° C. temp. between 20 drops and 95% CH.
[b] 1.0° C. max. distillation range between 20 drops and 95% CH.
[c] 137 to 140° C. distillation range between 20 drops and 95% CH.
[d] 25 ml. sample + 15 ml. H_2SO_4 shaken 20 seconds, neither layer should discolor.
[e] 15 ml. sample + 5 ml. H_2SO_4 shaken 20 seconds and allowed to stand 15 minutes. Hydrocarbon should be colorless; acid layer should not exceed color of 2 vol. H_2O and 1 vol. of a color std. soln. containing 5 gm $CoCl_2$, $6H_2O$; 40 gm. $FeCl_3$, $6H_2O$ and 20 ml. HCl per liter.
[f] A few mg. of isatin added to mixture of benzene + H_2SO_4 from preceding test is shaken well and allowed to stand one hr. Acid layer should not acquire a blue or green color.
[g] Total sulfur determined by lamp-turbidimetric analysis, UOP Method H-201.

the freezing point of 100% benzene as 5.533 ± 0.010° C.

Because the apparatus involved is much too elaborate for a routine method, nitration-grade specifications are based on ASTM Method D-852-47 which, though considerably simplified, gives results reproducible to ± 0.02° C. The relationship between freezing point depression and purity is shown in Fig. 2. Indicated on the plot is the range of depressions normally encountered in production as well as the freezing point of API-NBS Standard Sample benzene as determined by ASTM D-852.

The freezing point depression as predicted by the relationships in Fig. 2 has been confirmed experimentally on samples of Udex benzene by adding known quantities of toluene or methylcyclohexane. The presence of water has no effect on the specification solidification point, since this determination is made with a saturated sample and the freezing point subsequently corrected to an anhydrous basis. The specification of 4.85° C. or above for the solidification point seems inconsistently low in comparison with other ASTM specifications for nitration benzene.

However, it is possible that, when written, the solidification specification was liberalized to tolerate the presence of some non-aromatic contaminants not encountered in benzene such as produced in the Cosden Platformer-Udex units.

The effects of water, methylcyclohexane, and toluene on the distillation range of benzene is shown in Fig. 3. It should be noted that the presence of dissolved water, although not affecting the determination of freezing point, does have a marked effect on the initial boiling point of the distillation.

Thus, the limitation of a 1° distillation range between initial and dry points in the ASTM specifications re-

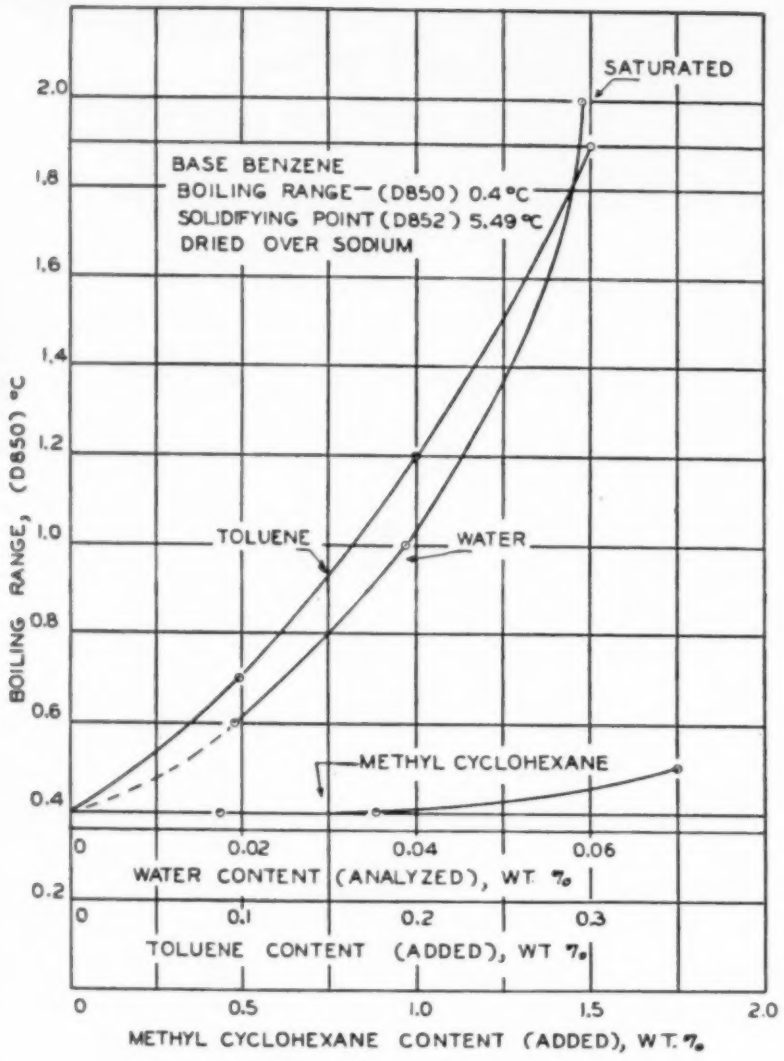

FIG. 3—Effect of impurities on boiling range of benzene

quires a substantially dry benzene. The ACS specification permits a completely saturated sample to pass, because the water of saturation goes overhead in the first 20 drops.

For a truer measure of purity in the benzene, it seems desirable to alter the ASTM specifications in such a fashion as to eliminate the effect of water content on the distillation range and, if necessary, to add a separate specification controlling water content.

Toluene of ASTM nitration-grade specifies a 1° C boiling range, but it has no purity specification as reliable as is the freezing point for benzene. Spectroscopic comparison of Cosden's Udex toluene with API-NBS material, as in the case of benzene, indicates extreme purity. Inspection of the non-aromatic concentrate has established the paraffinic impurity level at less than 0.02%-wt.

In commercial operation, the principal problem in achieving high toluene purity is that of avoiding contamination by benzene and xylenes when the aromatic concentrate is separated. The solution of this fractionation problem and the equipment employed has been discussed elsewhere.[3]

The xylene fraction currently produced at Cosden—this includes some ethylbenzene—does not meet ASTM nor ACS specifications for nitration or reagent-grade chemicals. Indeed, the Udex unit is operated to avoid the production of nitration-grade xylenes.

A comparison of Table 3 with the tabulated properties of the isomers as given in Table 4 reveals that the ASTM density specification limits the ortho-xylene concentration. It is not known if high concentrations of ortho-xylene are actually undesirable in nitration-grade xylene or whether the specifications were established to be compatible with the isomeric distribution and non-aromatic impurities normally encountered in producing xylenes derived from coal tar.

ASTM specifications for nitration-grade xylene allow a maximum paraffin content of 4%-wt. It seems logical to assume that the density specification as it now exists is such as to require some degree of balance between the ortho-xylene and the paraffin content in that the presence of one offsets the other as to the effect on density.

For example: the addition of 4%-wt. of n-nonane (density 0.7718) to the xylene described in Table 3 reduces the density from 0.8825 to 0.8648, that is, from above the maximum density specifications to below the minimum. Yet, it shows no effect on the distillation range.

Xylenes of less than 3° C. distillation range have been produced commercially, but the end point is approximately 1° above nitration specification. This indicates excess ortho-xylene or perhaps lack of certain paraffins. If it is desired to produce xylene meeting all the nitration-grade specifications, a 3° cut could be adulterated with 4% non-aromatics, or the xylene fractionator could be operated to exclude about one-half the ortho-xylene from the overhead product. This latter course is not expedient, since a market exists for the heavier C_9 aromatics comprising the xylene column bottoms.

However, it has been our experience at Cosden that the consumer is interested in purity and composition. It has been our practice to produce a xylene fraction with less than 0.10%-wt. non-aromatic impurity without purposely excluding ortho-xylene merely to meet nitration specifications.

General comments — The ASTM acid wash color (AWC) specification, D-848-47, is defined as: "the color developed in the separated acid when the sample is agitated with sulfuric acid under the conditions prescribed in this method." In addition to this requirement, the method also specifies that the oil layer should not be discolored.

The AWC test is extremely sensitive

Table 4—Properties of C_8 Aromatics

	B. pt. °C.	Sp gr., 60/60 F
Ethylbenzene	136.2	0.8718
Para-xylene	138.4	0.8657
Meta-xylene	139.1	0.8688
Ortho-xylene	144.4	0.8848

in the detection of trace quantities of certain unsaturates, especially conjugated diolefins. On the other hand, it is rather insensitive to mono-olefins, as illustrated in the data in Table 5,[6] which also includes the calculated bromine index (mg. of Br./100 gr.; numerically equal to 1000 times Br. No.).

Aromatics produced at Big Spring, with no treatment, have acid wash colors ranging from 2 to 10. Since the data cited refer to synthetic samples, the question arises as to the real source of the AWC of the aromatic product; i.e., is it due to conjugated diolefins or a non-hydrocarbon impurity? Analyses for these minute quantities is next to impossible and tests for peroxides, gum, and nitrogen compounds yield negative results. Treatment with maleic anhydride for diene removal and water and caustic washing, along with the known behavior of synthetic unsaturates toward AWC, indicate that traces of dienes must be removed from the BTX concentrate to meet specifications.

The time-honored technique for AWC improvement involves treatment with 93% sulfuric acid, followed by neutralization and re-running. Experimental laboratory tests established that such a procedure could be employed but only at the expense of 1 to 3% loss of aromatics by sulfonation.

A superior technique, thoroughly proved in commercial practice, utilizes treatment of the BTX concentrate with clay at polymerizing conditions, followed by distillation into the separate aromatics. Clay treatment has a number of advantages over sulfuric acid: 1) losses are negligible, 2) no emulsification problems are encountered, 3) acid disposal problems are eliminated, and 4) chemical costs are insignificant. Table 6 gives typical laboratory data on Cosden's BTX concentrate. Following clay treatment, the material was fractionated into finished products.

The data in Table 6 illustrate that clay treatment improves the AWC to enable the product aromatics to meet specifications and, further, there is a considerable reduction of olefinic unsaturation, as evidenced by the reduction in Bromine Index. In Cosden's operation, clay life has exceeded 8000 bbl/ton, representing a treating cost of 0.25¢/bbl.

Storage stability of the finished, clay-treated products is excellent. A number of samples of benzene stored under conditions simulating 100° F. tank storage showed no change in AWC after six months.

Both ASTM and ACS specifications relating to sulfur compounds are extremely rigid: copper strip corrosion, hydrogen sulfide, sulfur dioxide, total sulfur, and thiophene in benzene. None of these tests has caused difficulties because the Udex charge stock from the Platformer has such a low sulfur content. Of particular note is the absence of thiophene. Density, color, and acidity likewise offer no problems.

The authors wish to thank Universal Oil Products Co. for their analytical studies of the products and their helpful suggestions in the preparation of this article.

Table 5—Unsaturates in Benzene for AWC of 2

	%-vol.	Br. Index
Cyclopentadiene (dicyclopentadiene)	0.002	10
2-methyl-1, 3 pentadiene	0.01	20
Cyclohexene	0.1	195
2, 4, 4-trimethyl-2 pentane	2.0	2860
1-heptene	3.0	4900

Table 6—AWC Improvement by Clay Treatment

Clay Life Bbl/ton	Benzene AWC acid	Benzene AWC CH	Benzene Br. Ind.	Toluene AWC acid	Toluene AWC CH	Toluene Br. Ind.	Xylene AWC acid	Xylene AWC CH	Xylene Br. Ind.
Raw stock	10	3	110	3	1	10	4	0	31
0-250	0	0	—	0	0	—	0	0	—
250-500	0	0	—	0	0	—	0	0	—
500-750	1—	0	14	0	0	10	0	0	17
750-1000	0	0	—	0	0	—	0	0	—
1000-1250	0	0	16	0	0	10	0	0	16

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(1) Davis C. Read, *Petroleum Refiner*, Vol. 31, p. 97 (1952).
(2) D. P. Thornton, Jr., PETROLEUM PROCESSING, Vol. 8, p. 384 (1953).
(3) E. R. Fenske & D. B. Broughton, paper presented at ACS, Chicago, September 9, 1953.
(4) ASTM Standards on Benzene, Toluene, Xylene, Solvent Naphtha; ASTM Committee D-16 (1952).
5) Reagent Chemicals, American Chemical Society specifications, (1950).
(6) C. L. Dunn & G. E. Liedholm, *Petroleum Refiner*, Reference Annual (1952), pp. C7 to E10.

NOTE: The preceding article consists of the major portion of the paper "Reagent and Nitration Grade Chemicals by Platforming and Udex Processes," presented by the authors at the September 9, 1953, meeting of the ACS in Chicago, and made available exclusively to PETROLEUM PROCESSING.

W. K. Jackson is director of the organic chemicals division, C. K. Chadd is chief chemist, and Daniel M. Krausse is assistant to the president, Cosden Petroleum Corp., Big Spring, Texas.

Meet the Authors

Mr. Jackson

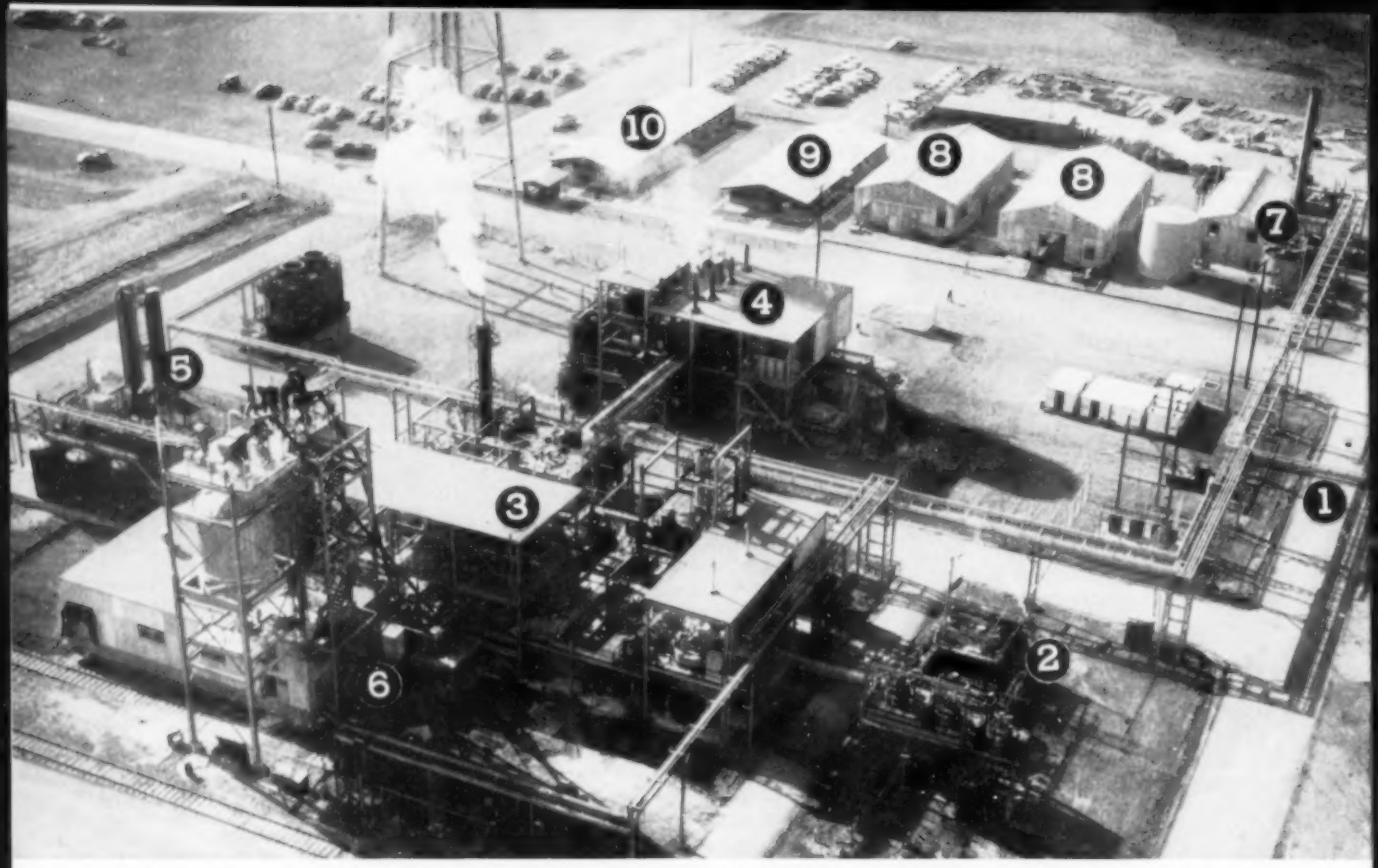
Mr. Chadd

Mr. Krausse

W. K. Jackson, director of the organic chemicals division of Cosden Petroleum Corp., was born in Texas in 1915 and obtained his B.S. in Ch.E. from Rice Institute in 1937. He was with Shell Oil Co. in St. Louis and Wood River until 1943, working in design and development. Mr. Jackson joined Cosden in 1943 as assistant chief engineer, became director of research in 1946, and subsequently took on his present duties.

G. K. Chadd, chief chemist for Cosden since 1941, is a native of Wilson, Okla., having been born there in 1913. He received a B.S. from the University of Oklahoma in 1936 and joined Cosden shortly thereafter as assistant chemist.

Dan M. Krausse has been assistant to the president of Cosden since 1952. Born in Houston in 1925, he obtained his B.S. in Ch.E. from the University of Texas in 1947 and then joined Sinclair Refining Co.'s research and development department in East Chicago, Ind. In 1949 he joined Cosden as control engineer and in 1952 took on his present post in which he coordinates the firm's manufacturing activities.



OVER-ALL VIEW of Monsanto Chemical Co.'s new synthetic phenol plant at Avon, Calif., recently put into operation. The plant employs the Dennis-Bull sulfonation process. Shown here are (1) pipe line bringing sulfuric acid from adjacent acid plant; (2) sulfonation area; (3) neutralization system; (4) fusion unit; (5) phenol refining unit; and (6) by-product recovery. Boiler and water treating is at (7), maintenance and stores at (8), the control lab is at (9), and the plant office is at (10)

New Plant for Synthesis of Phenol—

FIRST CAR of phenol is "christened" by J. Behrens, Avon employee. Watching are executives D. Williamson (left) and D. J. Miller

MONSANTO Chemical Co.'s new synthetic phenol plant at Avon, Calif., is now in operation—the first such plant on the west coast.

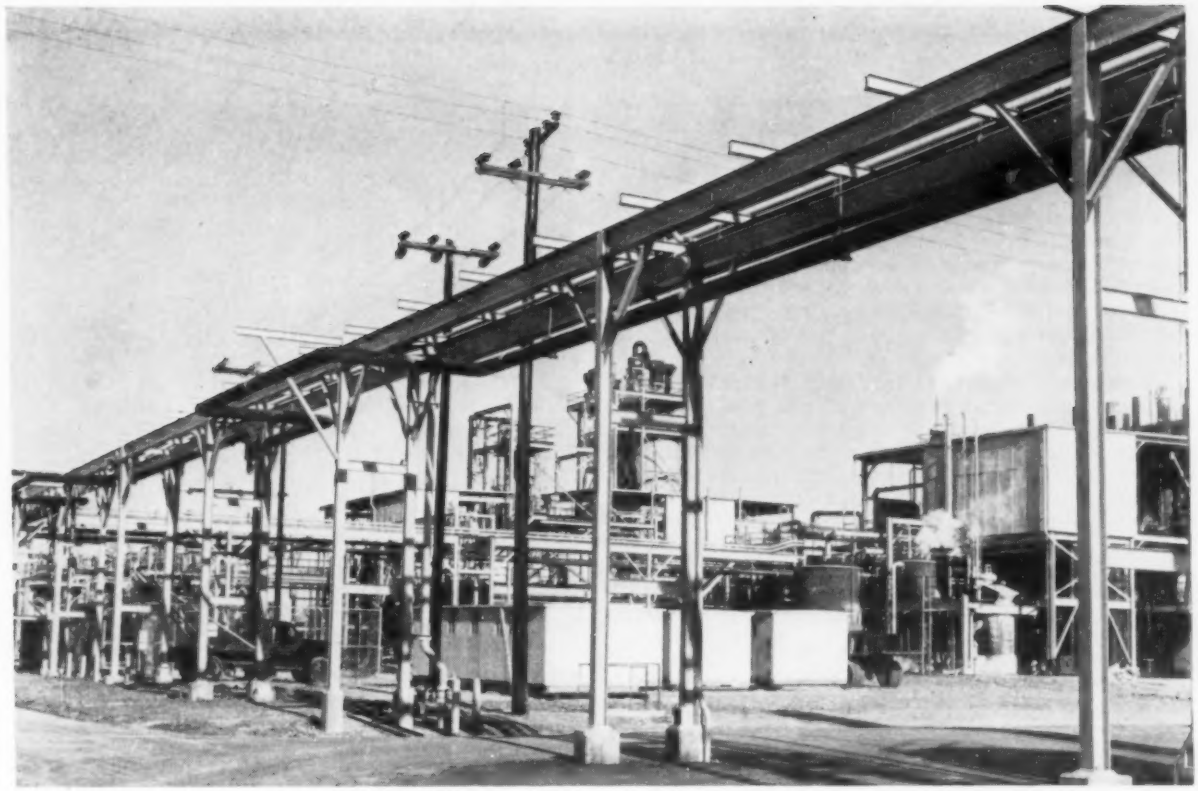
Using benzene and sulfuric acid as raw materials, the plant produces phenol by the Dennis-Bull sulfonation process, with modifications incorporated by Monsanto's engineers.

Capacity and cost of the plant haven't been disclosed by the company. One report, however, pegs output at Avon at a level of 30 million lbs./yr. According to Irving C. Smith, general manager of Monsanto's Western Division, which operates the plant, the Avon installation can supply all industries in the San Francisco Bay area and throughout the Far West with most of their present phenol needs—and can easily be expanded to meet foreseeable demands.

Phenol produced at Avon will be sold on a contract basis to various firms in the growing Pacific Coast industrial area and also will be used by Monsanto in its own western manufacturing operations.

On the cost side, Monsanto received a DPA certificate of necessity about two years ago for new phenol facilities at Monsanto, Ill., at a cost of $5,403,478. That certificate was later amended to $7,030,875 in July of '52, and apparently applied to the Avon project.

Location of the plant is a 412-acre site in Contra Costa County, about 30 miles northwest of San Francisco, and just south of Tide Water Associated's 90,000 b/d refinery at Avon.



PIPE LINE carries sulfuric acid to phenol plant from adjacent acid plant, and by-product sulfur dioxide back to acid plant

1st on West Coast

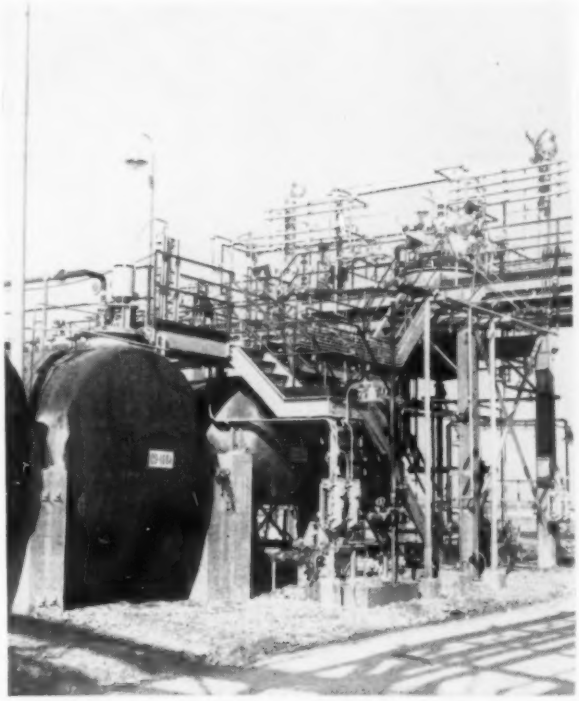
On the same site with the phenol plant is a new 240-ton sulfuric acid plant (also recently completed), owned jointly by Monsanto and Tide Water, and operated by the former. The acid plant uses the Monsanto-Ross-Wilde process to convert waste acid sludge and hydrogen sulfide from Tide Water's refinery to concentrated acid.

Process equipment employed by Monsanto for synthesizing phenol is illustrated in the accompanying photos. Briefly, benzene and sulfuric acid are piped into 2000-gal. sulfonation tanks, and then through a neutralizer system. The resulting slurry mixture goes through fusion tanks, after which crude phenol is separated from the sulfite mother liquor and then refined.

A more complete description of the basic sulfonation process for phenol synthesis was published in PETROLEUM PROCESSING last year. ("Synthetic Phenol Manufacture—Part 3—Sulfonation and Chlorination," by Peter W. Sherwood, Nov. '53, pp. 1722-28.)

The so-called Dennis-Bull method is the oldest commercial method for synthesizing phenol, according to Monsanto, and is the one used at Avon. The improvement of the process is described by Monsanto as "an interesting solution to a knotty problem accomplished by the chemical industry."

The original process used 100% sulfuric acid and the excess was neutralized later. A major problem existed in the dilution of the acid by water produced in the reaction. The Tyrer method (1917) improved this situation by passing benzene vapor through sulfuric acid at concentrations as low



SULFONATION EQUIPMENT, with sulfuric acid, benzene and benzene sulfonic acid storage tanks in left foreground

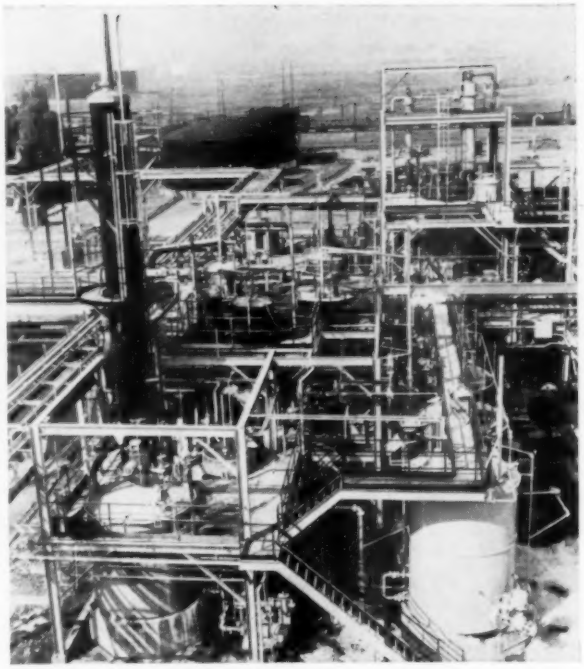
as 90% and at temperatures varying from 100 to 180° C. The unreacted benzene carried out water, keeping the acid concentration constant.

Then Dennis (1917) found that benzene would take up 2% to 3% of its own volume of benzene sulfonic acid, and Bull (1917) developed a process which saved 90% of the excess sulfuric acid as spent acid with a concentration of 70 to 77%.

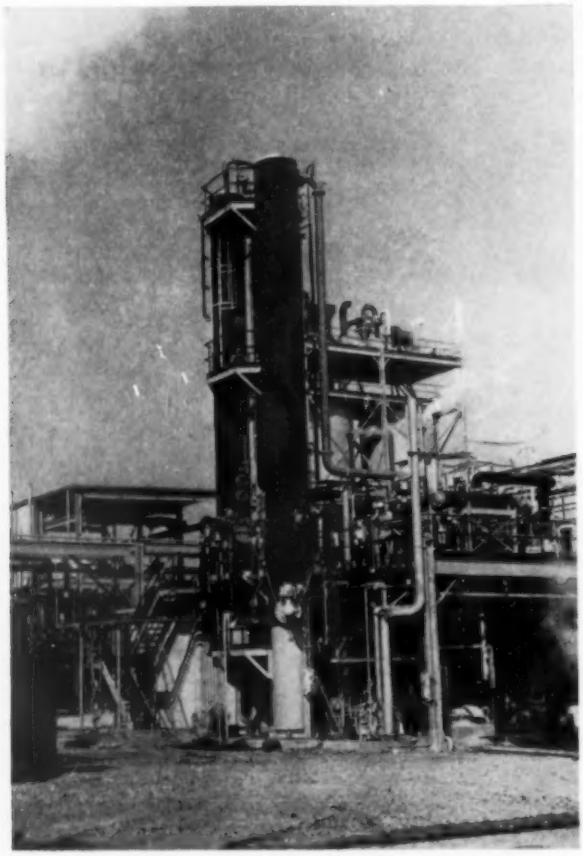
This development became the Dennis-Bull process, in which sulfonation and extraction were carried out in one operation, the sulfonic acid was removed from the benzene with water, the aqueous solution was evaporated to remove benzene, and the resulting product was neutralized. The phenolate was neutralized with carbon dioxide instead of sulfuric acid.

Management personnel at the Avon plant include D. J. Miller, plant manager; Ted Harris, acid plant supervisor; Dominic Danna, phenol plant supervisor; Art Lindroth, laboratory supervisor; Bill Colgan, maintenance supervisor; Bob Powell, personnel supervisor; and Joe McNulty, accountant. Approximately 100 employees are required to operate and maintain the installation.

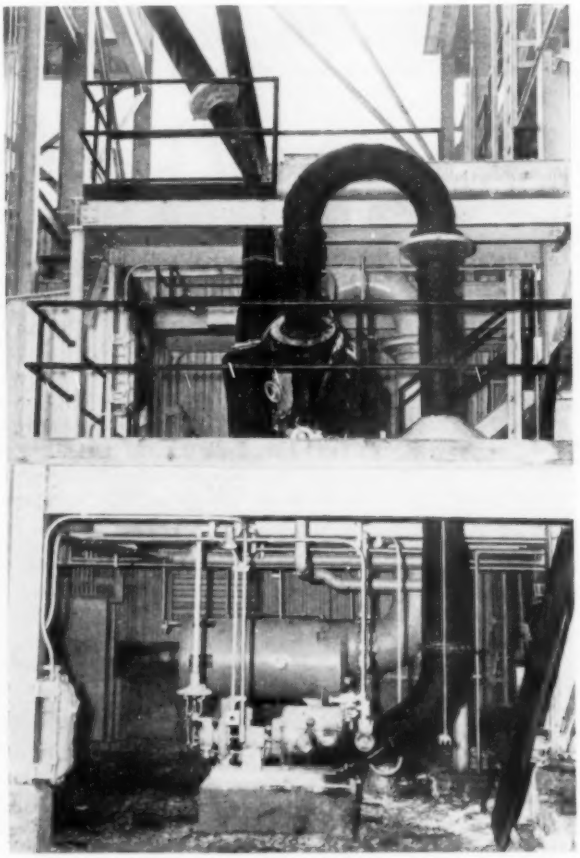
Prime contractor on the job was United Engineers and Constructors, of Philadelphia. The Lou Jones Construction Co. built the general office building (one-story, 5000 sq. ft. of floor space), and the quality control laboratory building (for testing of the raw materials and finished products).



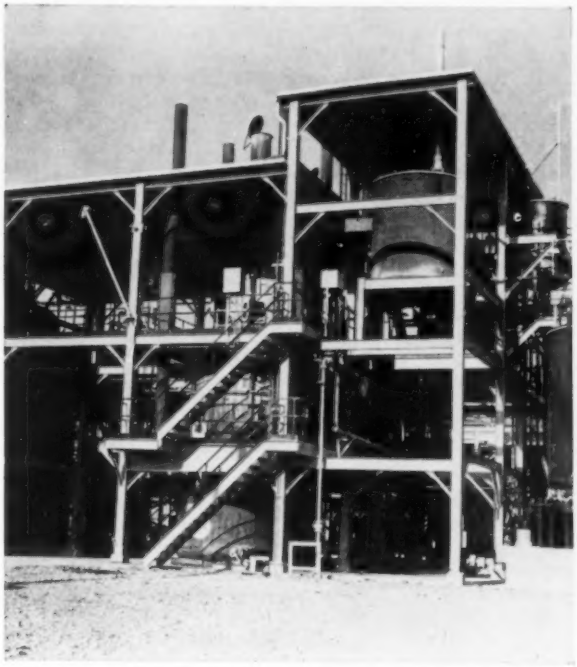
NEUTRALIZATION, ACIDIFICATION and EVAPORATION area. Sulfuric acid plant is in middle background at left



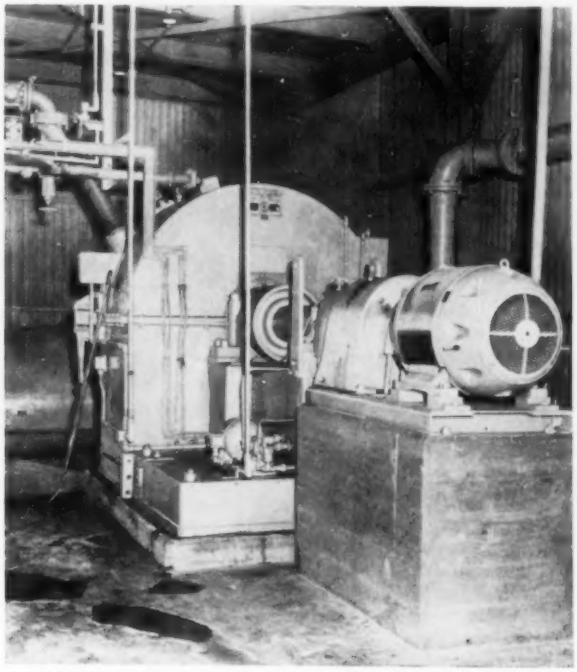
REFINING unit, in which crude phenol is purified



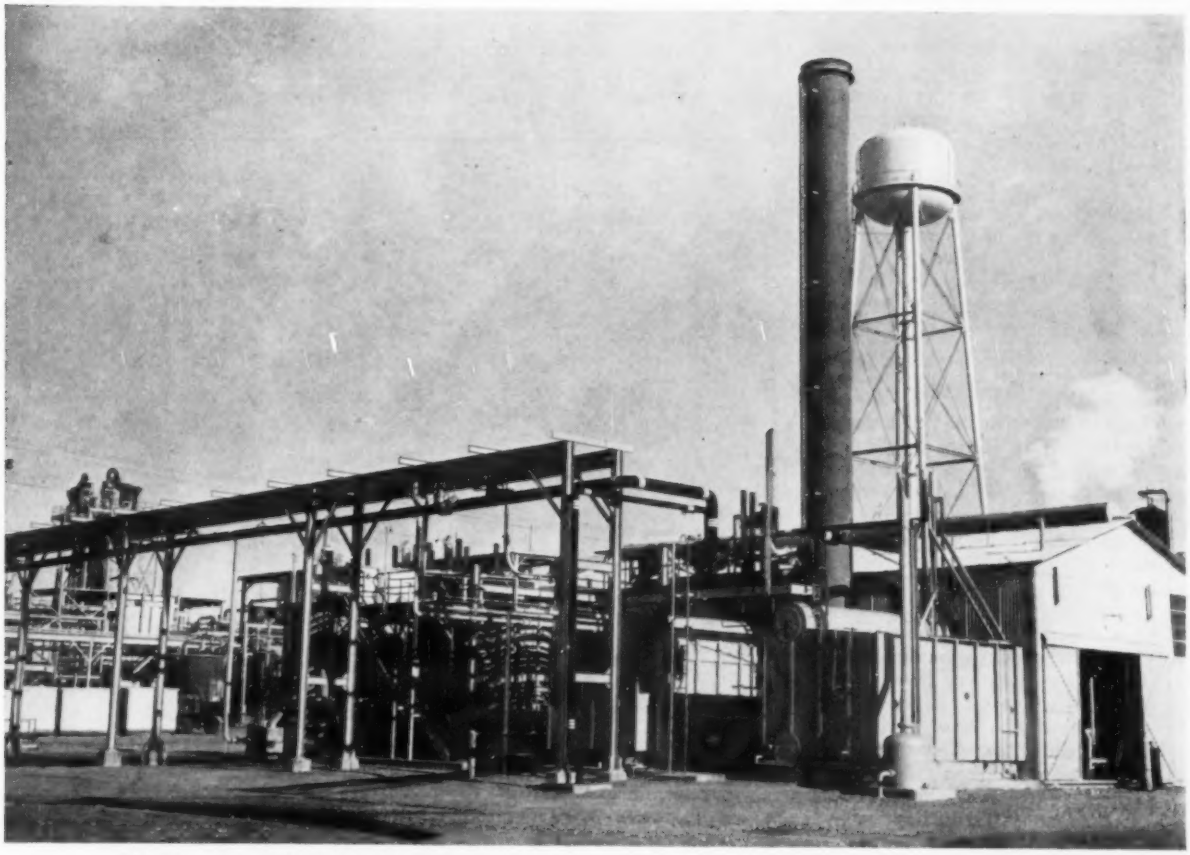
BY-PRODUCTS are dried in this flash dryer installation



FUSION unit, with quencher and centrifugal installation



CRUDE PHENOL is separated from mother liquor in centrifuge



BOILER and WATER TREATMENT plant, supplying steam, air and water to all parts of the phenol plant

Do You Know These Words?

By B. H. WEIL

Manager, Information Services
Ethyl Corp., Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Acrylic Fibers

Acrylic Fibers, petrochemicals in every sense of the word, are today becoming firmly established as commercial materials, following an introductory period in which their superior qualities spurred on producers and processors alike to overcome difficulties in dyeing and handling. Pronounced "ah-**kri'l**-ick," they are derived in whole or in part from acrylonitrile, from which they gain both their family name and petrochemicals membership.

Acrylic fibers are generally of high strength (both dry and wet); have silk-like luster, hand, and drape; are highly resistant to mold, mildew, many chemicals, sunlight, and outdoor exposure; may be set by heat; are wrinkle-resistant; dry rapidly; and are stable to both wet and dry cleaning. Accordingly, they are finding wide usage in consumer fabrics (shirts, blouses, dresses, lingerie, suitings), where their ease and speed of washing place them in a premium category. They are also finding industrial uses based on their stability and strength.

Acrylonitrile, as mentioned in previous items in this series, is derived from petroleum or natural gas, with ethylene or acetylene as intermediates; both of the latter are produced by pyrolysis of appropriate fractions. In addition to its use in the manufacture of synthetic fibers, acrylonitrile is finding increasing markets in the fields of soil conditioners and synthetic rubber. Acrylic fibers are generally produced from acrylonitrile by polymerization (linkage of individual molecules together to form long chains). At least one of the acrylics also contains another monomer (polymerizable chemical) in its fiber chains—vinyl chloride.

Market forecasts for the acrylic fibers are as spectacular as their brief but vivid history to date. The President's Materials Policy Committee predicts that consumption will reach 325,000,000 lbs. in 1960 and 1,200,000,000 lbs. in 1975; in both years, production of these fibers is expected to top that of any other type of synthetic fiber. Apparently, they will provide a growing market for their parent chemical, acrylontrile.

Ammonia

Ammonia, pronounced "ah-**moe**-nih-aah," is today chiefly a petrochemical, something which chemistry students and practitioners alike would never have predicted 15 years ago. It is a colorless gas, lighter than air, and has an extremely pungent smell and taste. It boils at —28.3° F. and is easily liquefied by pressure alone.

Until 1913, ammonia was produced almst exclusively as a by-product from coke ovens, and until 1931 its high-pressure synthesis from nitrogen and hydrogen (it has the formula NH_3) depended upon the coke-water gas reaction or electrolytic cells for the hydrogen required.

Today, hydrogen obtained from natural gas accounts for about 60% of ammonia production, and it may exceed 75% by 1955.

Uses for ammonia are legion. It is employed in refrigeration; in the synthesis of many organic compounds and consumer products made from them; in the manufacture of nitric acid; in rubber vulcanization; in water treating; in oil refining; etc.; etc. More important to the recent trend toward production as a petrochemical, it is itself a fertilizer material and may be converted into other and even more important commercial fertilizers—ammonium nitrate, ammonium sulfate, and urea. As will be recognized, also, ammonium nitrate is a leading explosive and munitions material.

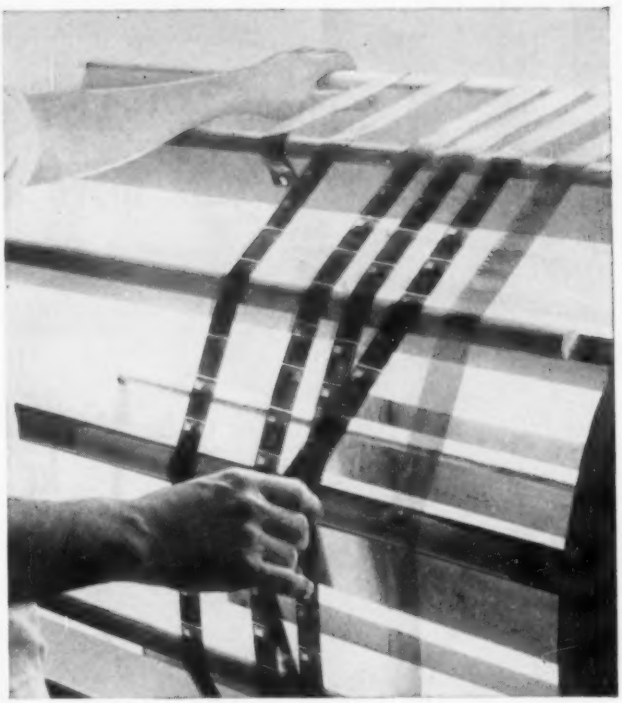
The hydrogen required for the synthesis of ammonia is generally obtained by the reaction with steam of methane or other lower hydrocarbons (from natural gas), yielding a mixture of hydrogen and carbon monoxide (the basic "synthesis gas" for methanol production or the Synthine synthesis of gasoline). More hydrogen is then produced by further reaction of the mixture with more steam, which also converts the carbon monoxide present to easily-removable carbon dioxide. Hydrogen may also be produced from hydrocarbon gases by partial combustion, and it is a by-product from the catalytic reforming of naphthas.

While ammonia has been used in increasing quantities for generations, the end of its pattern of growth is not in sight, for new and expanding markets continue to be found for its derivatives. Since these include fertilizers, synthetic fibers, synthetic rubbers, and countless other chemicals, its future appears good indeed.

NEWS in VIEWS

NEWEST ETHYLENE PLANT, that of Semet-Solvay Petrochemical Division of Allied Chemical & Dye Corp. at Tonawanda, N. Y., is unique in that the ethylene is derived from gas produced from fuel oil. Most plants have been built near natural gas lines. Product of this unit is sent to an adjoining polymer plant for processing into polyethylene. Expected rate of production is 20,000,000 lb./year. Plant design and construction was by Lummus.

Paint, Varnish and Lacquer



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Decyl Alcohol
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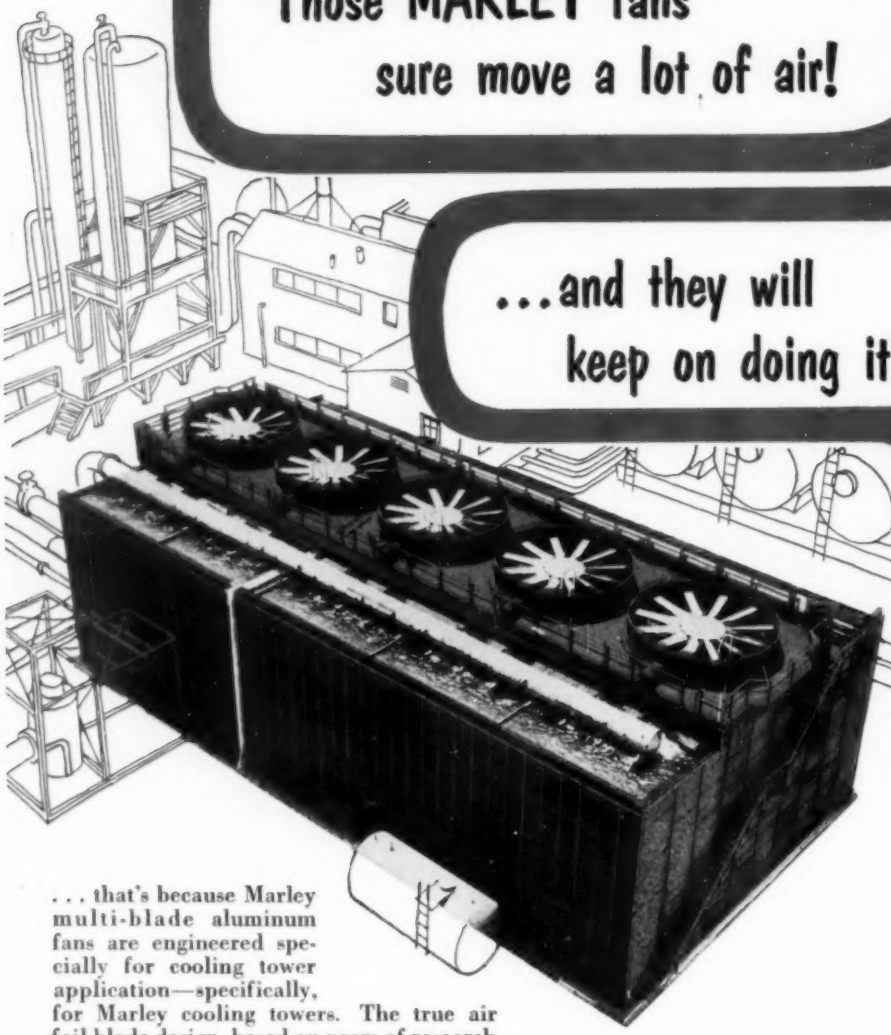


. . . that's because Marley multi-blade aluminum fans are engineered specially for cooling tower application—specifically, for Marley cooling towers. The true air foil blade design, based on years of research and wind tunnel testing, was selected as the most efficient for the range in air velocities and pressures found in various types of cooling towers. The twist and taper of the wide, sturdy blade is designed to provide constant velocity from hub to tip. By using six to twelve blades, depending upon fan diameter, Marley fans operate more smoothly and quietly.

Another reason Marley fans move a lot of air is that they operate in Marley Laminated Fan Cylinders, developed to complement the performance of this particular fan. Marley fans, air delivery cylinders and Geareducers are engineered as complete functional units, assuring the balance necessary to attain top fan efficiency.

Durability and strength are important, too. These are achieved by utilizing the newest casting techniques and an aluminum alloy selected for its castability, strength and corrosion resistance. Every dimension from shank to tip is more than ample for any operating load encountered.

For further details write for Bulletin No. CF-54 or contact your nearest Marley representative in any of fifty major cities.

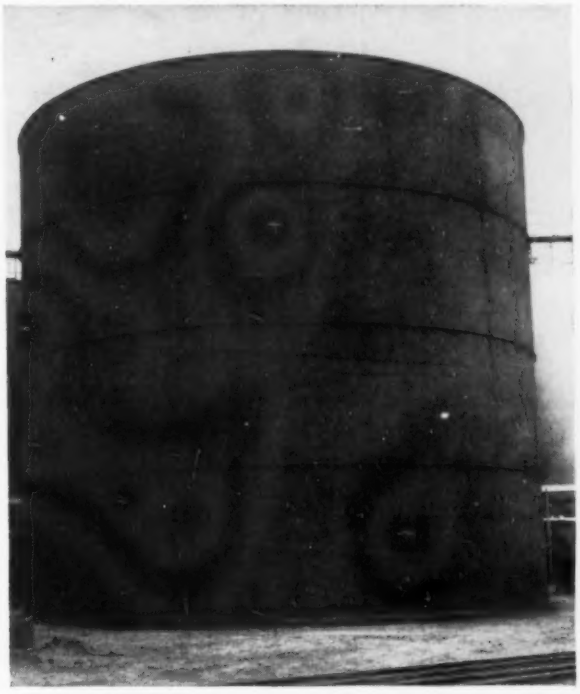
The Marley Company

Kansas City, Missouri

Founder Member
Cooling Tower Institute

MARLEY

RAPID FAILURE of tank insulation applied by conventional methods led to use of . . .



HIGHLY DURABLE, mastic-type coating which is sprayed on for relatively low cost

Sprayed Insulation Reduces Maintenance

A PROBLEM of maintenance of insulation on fuel oil and other storage tanks at the East Chicago, Ind., refinery of Sinclair Refining Co. is being whipped by a lightweight mastic coating which is applied by spray gun for a relatively low cost and is said to outlast previously used conventional types of block insulation by many years. It is estimated that heat loss is reduced by approximately 50% for tankage containing liquids at temperatures up to 200° F.

Consisting of a bituminous vehicle mixed with 55-60 vol.-% of fillers such as cork and asbestos, the material is sprayed on to a thickness of about ¼ in. and costs 35-65¢/sq. ft., plus 10-15¢/sq. ft. labor charges when done by an outside contractor. At East Chicago, the work is being done by such a contractor who provides a 10-year guarantee on the job.

These costs compare to the following for other techniques, as calculated by Sinclair: $1.35/sq. ft. for fiber glass and aluminum sheet (both labor and material); and somewhat higher figures for conventional block insulation. However, the block insulation, for example, begins to fail in as little as 2 or 3 years. (See photograph.)

Approximately 15 tanks have been coated by the new procedure at East Chicago. Three fuel oil tanks (with coils and suction heaters) of 150 ft. diam. and 150,000 bbl. capacity have been coated on the shell only. Ten tanks handling lube oil stocks and materials at the wax plant, ranging in diameter from 48 to 55 ft., have been coated on roof as well as shell; and two 48-ft. lube oil stock tanks have been coated on shell only.

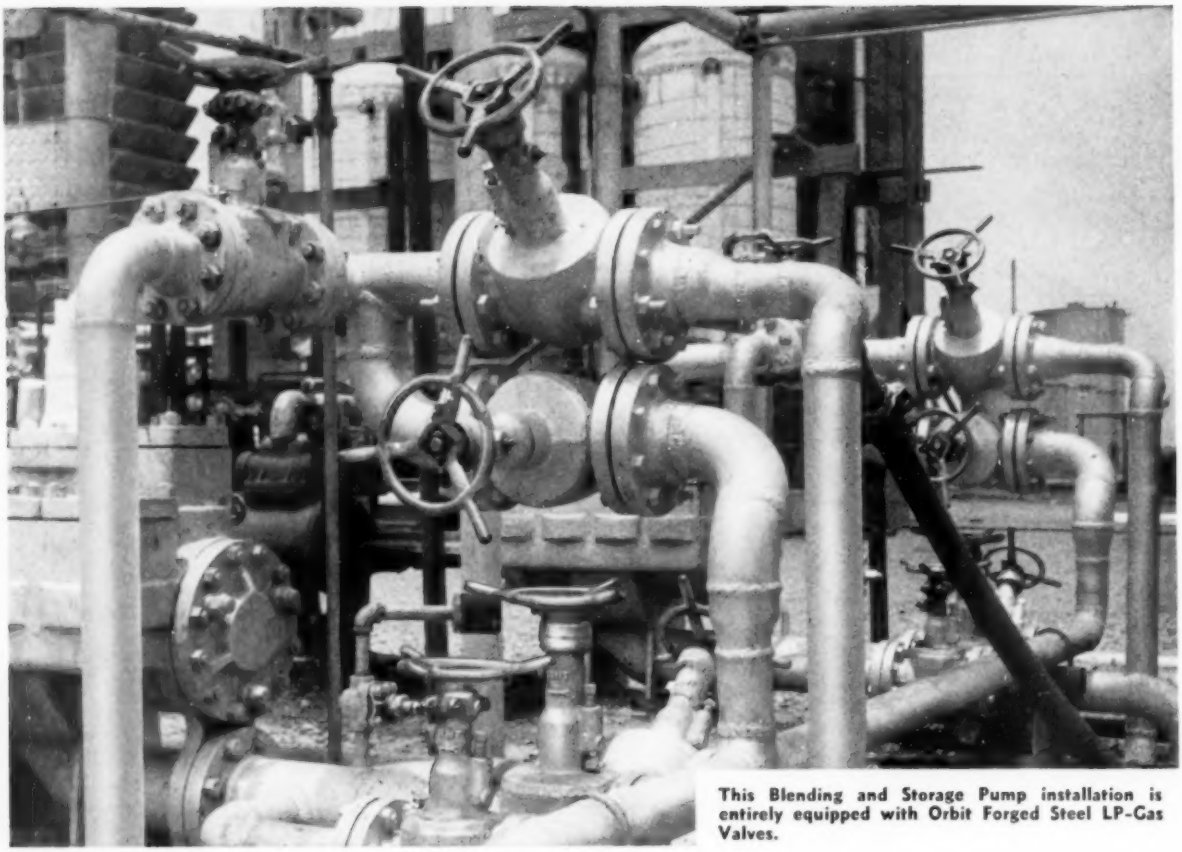
In addition, one other tank has been given a ⅜-in. thick coating because it is being used to store cutback asphalt and it was desired to hold a temperature of about 300° F., slightly higher than the requirements for the other tanks.

Sinclair has found some added protection for the insulating material is needed near vents and sample openings and around manholes, where spillage, leakage, and the like tends to soften the mastic. The company plans to provide this protection with a thin Neoprene coating which can be brushed or sprayed on at these locations.

The result in appearance of the finished tank is perhaps not quite as "dressy" as others (see second photograph). However, there is no deterioration of the surface and virtually nothing in the way of a continuing maintenance problem, Sinclair has found.

A saving feature in the application of the mastic is that a minimum of preparation is required. The tank surface is given a solvent and an acid wash and then wire-brushed. Occasionally, some sand-blasting may be necessary.

The particular mastic Sinclair is using at East Chicago is a so-called cold application type manufactured by Witco Chemical Co. and trade-named Witcote No. 820 cork insulation. The accompanying photograph shows it being applied by spray-gun, in this case to a corrugated sheet-metal wall. The approximate quantity required for a ¼-in. thickness is 20 gals/100 sq. ft.



This Blending and Storage Pump installation is entirely equipped with Orbit Forged Steel LP-Gas Valves.

First Choice for Handling Light Ends

Orbit Forged Steel LP-Gas Valves insure a vapor tight shut-off, eliminating contamination. Reruns are eliminated and product quality is maintained. Besides there are no voids in the body of an Orbit LP-Gas Valve to trap fluids that could become dangerous in case of fire. When the valve is closed it drains clean to either side of the line — in case of reversed pressures it still holds vapor tight.

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Orbit LP-Gas Valves are competitively priced. They soon pay for themselves through high type performance and low-cost maintenance. Orbit's Friction Free Seating Principle account for these advantages.

Include Orbit LP-Gas Valves on your next blue prints for a new Hydrocarbon Plant or expansion program. Install them when making replacements within your plant. Many other uses include underground and surface storage installations, tank car and truck loading racks. Orbit LP-Gas Valves carry Underwriter's Laboratory approval which you will find clearly stenciled on the body of each valve.

These valves are full round opening and available in both flange and screw ends, ASA Class. Maximum rated working temperature 250 Degrees Fahrenheit. They are all forged steel — welded bonnet construction.

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This thickness can be achieved in a single application.

Drying time varies with atmospheric conditions, but the material will set hard in about 3 to 5 days. However, a surface film begins to form immediately after application, permitting any additional coating to be applied right away. The ¼-in. coat (5 sq. ft. to the gal.) has a dried weight of about 0.70 lb./sq. ft.

Permanent "K" value (thermal conductivity per sq. ft. per in. of thickness) is reported to be approximately 0.30 at temperatures between 100 and 200° F. This is in the low range of cork board and other glass and fiber vegetable boards. It is not destroyed or affected by penetrating moisture-vapor. Water permeability rate of the mastic is not over 0.1 grain per sq. ft. per hr. per ⅛-in. thickness.

Answer to a Pump Corrosion Problem

THE following presents a suggested solution to a corrosion problem in a refinery pump application. It is based on information developed in a conference at Montreal for representatives of several Canadian oil companies and of International Nickel Co. of Canada, Ltd. It was prepared for PETROLEUM PROCESSING by John F. Mason, Jr., corrosion engrg. section, development and research dept., International Nickel Co., New York. A major portion of Mr. Mason's work appeared in an article in September, 1953, pp. 1332-1335.

Problem: What is recommended material for centrifugal pumps handling catalyst slurry in a new Fluid catalytic cracking unit? Current practice has been to use 12% chromium steel castings.

Discussion: This is a major deterioration problem in the operation of Fluid catalytic cracking units. It is doubtful that the present 12% chromium steel castings will last any longer than about a year since previous experience with 17% chromium steel has indicated that that is just about the limit of its life. Abrasion or erosion is the principal factor involved in the deterioration of the pumps, together with corrosion caused by crude oil at the temperature range of 600-700° F.

Ni-Resist, 18-8 stainless steel and overlays of Colmonoy and Stellite have been tried with no success. As a matter of fact, the performance of these materials was inferior to that of the 17% chromium steel composition. Hard chromium plate to a thickness of 4.5 mils has also been tried but the adherence of the deposit was poor and the performance was, therefore, unsatisfactory. It is not certain whether anyone has had any experience with Ni-Hard in this application but this material merits consideration and is worthy of trial. This nickel-chromium white cast iron possesses outstanding abrasion resistance due to its high hardness of about 600 Brinell. Furthermore, it would seem that its corrosion resistance should be adequate.

As an example of Ni-Hard service at elevated temperature, several thousand bushings have performed well under abrasive conditions without lubrication at 900-1000° F. in chains for hot catalyst elevators. After a service life of 14,000 hours the bushings were reversed and served for a similar period. The bushings had an original hardness of 600 Brinell. After 5000 hours operation the hardness at room temperature was still 578 Brinell.

Tips on Ball Bearing Maintenance

SHAFT bearings play an important role in the service life of an electric motor or a pump. Proper fit, installation, and lubrication all are important factors in obtaining good service.

Following is a continuation of a series of questions and answers started a few months ago in these pages dealing with this problem. They were a portion of a seminar on the subject conducted at the Aruba, Netherlands West Indies, refinery of Lago Oil & Transport Co. by Mr. Jack Cannon, Continental Electric Co., and made available to PETROLEUM PROCESSING by Lago.

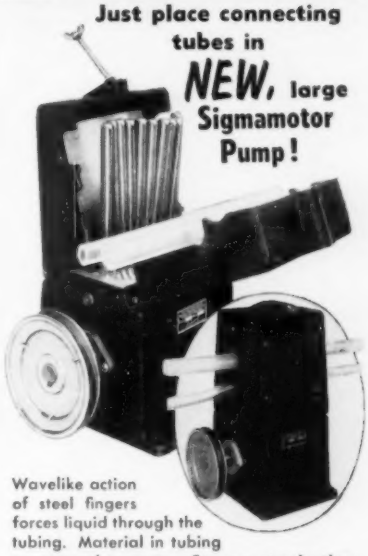
The problem of lubrication, and particularly grease lubrication, is covered in this month's questions and answers:

How do you know whether to use oil or grease to lubricate a motor?

If a motor has oil bottles on it, or if the name-plate states that it is an oil-

Pump liquids, gases, solids in solution

Just place connecting tubes in NEW, large Sigmamotor Pump!



Wavelike action of steel fingers forces liquid through the tubing. Material in tubing never touches pump. Stops contamination and corrosion. Excellent for handling of corrosive solutions. **$195.00**

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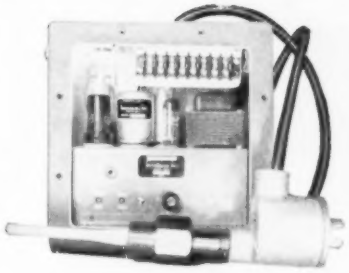

ELECTR-O-PROBE

Distinguishes liquid level, foam, or even interface between liquids

Probe of this "On—Off" instrument will operate at temperatures as high as 1500° F

USES: Controller gives an "on—off" signal when level covers the probe. Can be used to detect liquid or foam level and operates well with viscous fluids, acids, bead and powder catalysts or even in locating a liquid—liquid interface.

FEATURES: Sensitivity control may be adjusted so that instrument reacts to or ignores foam.

DESCRIPTION: Liquid level controller reacts to a change in capacity when probe is covered by a liquid or other flowable material. Capacitance change causes a radio-frequency oscillator to reduce or completely stop oscillation when level rises above the probe. Oscillation starts again when level falls below the probe. This change in operation is used to generate a DC voltage signal, which through an amplifier, operates the relay. A plug-in type relay is normally furnished with a DPDT set of contacts—other arrangements may be obtained for special applications.

For detailed information on any problem write to ELECTRONICS DIVISION of

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NO WATER IS SLIME-FREE

regardless of the source. Chlorination helps reduce slime in process or cooling water.

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lubricated motor, then you must use oil and never grease. If, on the other hand, it has grease fittings or grease plugs, then you must use grease only and not oil.

Will lubrication make any difference in the life of the bearing?

Yes, a bearing that is properly lubricated will always outlast one that is not. Proper lubrication is very important to any bearing application.

Which is better—grease or oil lubrication—and what are the differences?

Oil is preferred to grease for lubricating practically all bearing applications. Oil affords a means through glass or plastic bottles to know if there is sufficient lubrication for the bearing. Oil of the proper type is light enough so that any particles of metal or other dirt will settle to the bottom of the oil reservoir. Oil is more readily kept clean before it is put into a bearing housing than is grease, because you can keep it in an oil can, whereas grease is usually dispensed from a can with a large opening.

Oil has a much lower viscosity than grease; therefore, it does not present such a great friction problem to the rolling balls or the rollers. On vertical motors, oil can be pumped and returned again and again to the upper bearing so that it flows through to the lower bearing. On the other hand, once grease passes through a vertically operated bearing, it cannot be returned to the top again.

Grease will always retain whatever dirt or metal filings that get into it. Therefore, unless it is clean, it will act as a lapping compound. There is always a tendency on the part of the maintenance man to over-grease a bearing, because you cannot tell how much grease is inside the housing.

Just how much grease should be put into a ball bearing housing?

That amount that will fill the housing about 1/3 full. The grease should always be placed in the lower portion of the bearing cap and bearing housing.

Are double-shielded bearings lubricated for life?

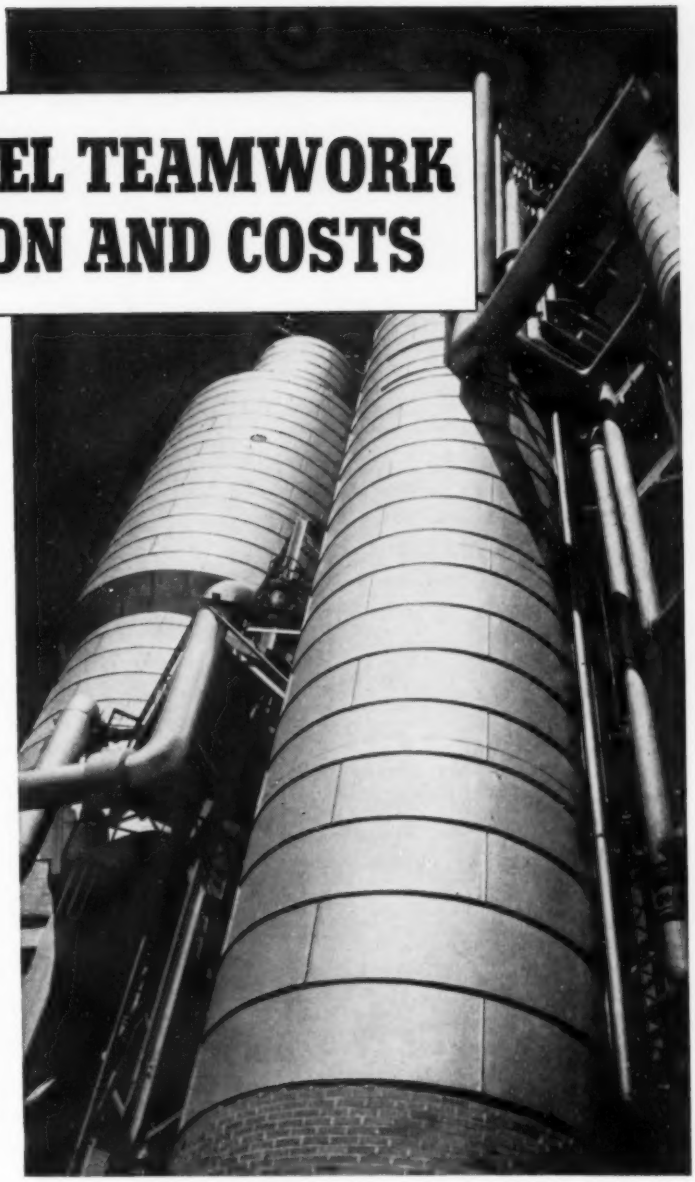
Usually no. Unless the shaft speed is low, such as 900 rpm. or less, the grease inside the double-shielded bearing is thrown by centrifugal force into the ball track of the outer race. This creates considerable friction and heat, which soon causes a bearing failure because the oil separates from the soap of the grease.

Should you add more grease to a bearing when it is running hot?

No. Some of the excess heat may be due to too much grease already in the housing.

 (To obtain more data on advertised products see page 276)

HOW CLAD STEEL TEAMWORK CUTS CORROSION AND COSTS



Two clad steels combine specialized talents to lick corrosion in this 20,000-barrel-per-day refinery unit

Selecting material for this two-stage refinery unit was a double-tough problem. The upper section of the atmospheric tower had to withstand the corrosive action of condensing mineral acids and organic chlorides . . . the lower part had to handle corrosive asphalt crude containing up to 2.50% sulphur concentrations. The vacuum still had to process a lube cut at 750°F. The equipment builder solved the corrosion problem *economically* by teaming up two clad steels: Monel-clad for the upper part and stainless-clad for the lower part of the atmospheric tower, and stainless-clad throughout the vacuum still.

With economical clad steel—a layer of solid high alloy permanently bonded over its entire surface to a low-cost carbon-steel backing plate—there is no possibility of seepage or crevice corrosion . . . no costly maintenance or downtime . . . no equipment failure. In addition, clad steels assure resistance to thermal shock, flexible efficient operation, low first cost and easy economical field erection.

Equipment values like these also result from another kind of teamwork. Sound engineering and modern fabricating techniques can take advantage of the versatility of clad steels. You will find that it pays to consult your fabricators *early* in your planning for tanks and pressure vessels. They can work with your engineers and consultants, translate ideas into the specialized equipment you require.

Ask one of your fabricators to show you the new Lukens clad steel movie, "Equip for New Profits." Here—in full color and sound—are factual accounts of how clad steel equipment brings new economies. The story can suggest new ideas to everyone concerned with production efficiency. Or contact Manager, Marketing Service, Lukens Steel Company, 682 Lukens Building, Coatesville, Pennsylvania.

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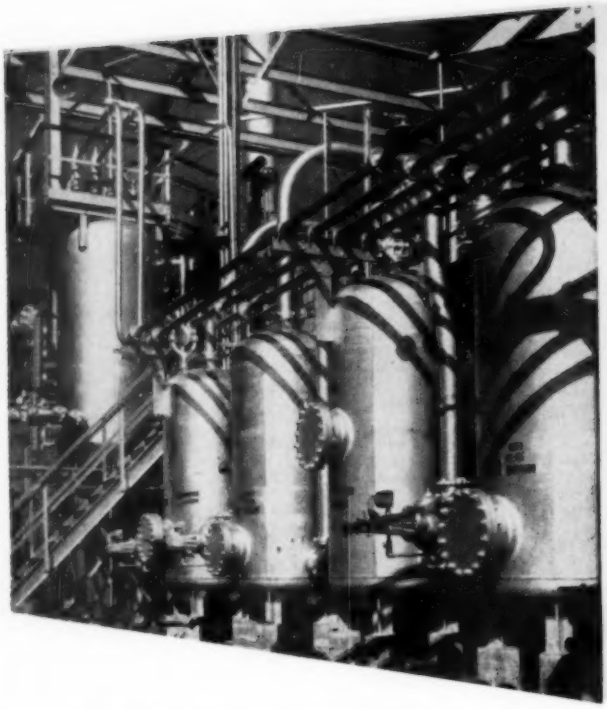

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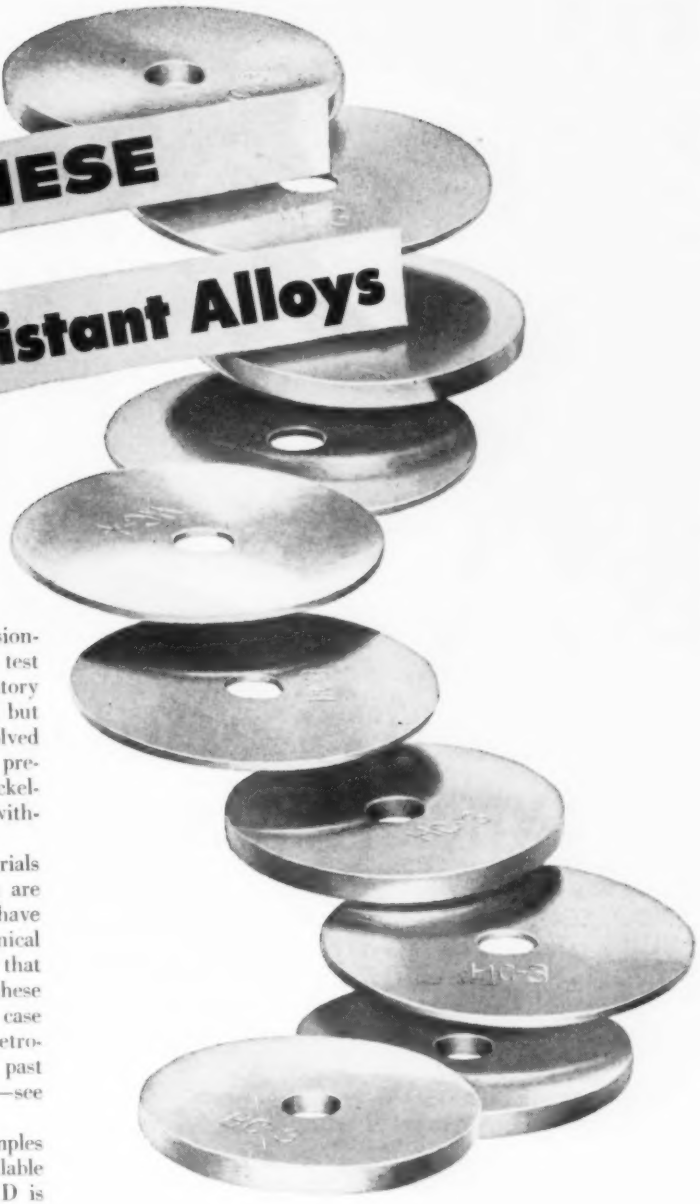

. . . and see for yourself how economical they are

The only way you can be sure that a corrosion-resistant material will work in your plant is to test it under actual operating conditions. Laboratory tests will give you some idea of what to expect, but they don't show the effects of the variables involved in production operations. That is why we have prepared standard test specimens of HASTELLOY nickel-base alloys . . . and they are available to you without cost.

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Use the handy coupon below to order your samples of HASTELLOY alloys. Alloys B, C, and F are available in either cast or wrought forms, while alloy D is supplied as castings only. If the equipment you have in mind is to contain welded joints, be sure to advise us, so that we may furnish you with welded samples.

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What you will want to know about the ANTIOXIDANT SWEETENING PROCESS

Since antioxidant sweetening offers many advantages, the chances are that you are looking for all the available technical information on the subject.

In answer to a number of requests, Du Pont has prepared a comprehensive booklet on antioxidant sweetening. It contains more information on this subject than ever before published in one volume.

Economy Features—The booklet presents information on how you may reduce your treating plant operating and equipment costs through Du Pont Antioxidant No. 22 as a sweetening agent. It also shows how you may eliminate loss in gasoline or octane number through the use of the process . . . as well as sweeten *and* inhibit your product in a single step.

The booklet also gives many helpful hints on controlling the operational variables involved and on getting best results without adverse effects on your product.

In addition, a briefer, 4-page folder outlining the advantages of antioxidant sweetening is also available from Du Pont.

Your Copies of the above booklets can be obtained from any of the Du Pont Petroleum Chemicals Division district offices listed below.

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By Peter J. Gaylor, Patent Attorney, Newark, N. J.

Up Benzene Yield by Adding Oxygen To Hydrogen when Aromatizing C_6's

WORKERS at Sinclair Refining Co. discovered that the introduction of a very small amount of oxygen with the hydrogen supplied to the reaction zone in the catalytic aromatization of C_6 fraction results in a surprising increase in the yield of total recoverable liquid products and a surprising specific improvement in benzene yield.

In their U. S. Patent 2,661,383, they describe the conversion process conducted in presence of a molybdenum oxide-alumina-silica catalyst at 850°-1000° F. at atmospheric to 250 psig. pressure and a space velocity of about 0.15-2.0, with a molar ratio of hydrogen to hydrocarbon feed between 2/1 and 8/1. The hydrogen is usually a recycle gas stream to which is added 0.001-0.2% of oxygen, either in the form of air or pure oxygen. The use of pure oxygen avoids the build up of nitrogen in the recycle gases. Even traces of oxygen in the recycle hydrogen effects improvement in yield, and improvement appears to increase linearly with the addition of oxygen up to about 0.1%, or about 0.5% air, where the rate of improvement levels off.

The straight run naphtha is prefractionated to obtain a fraction boiling at 140°-185° F., which is preheated and contacted with a fixed catalyst bed, using a catalyst such as Harshaw Chemical Co.'s Mo 0201 containing 83.8% Al_2O_3, 10.14% MoO_2, 5.04% SiO_2, and 12.8% volatile matter at 1600° F. Carbon content is 1.80%. Surprisingly, catalysts containing only traces of or no silica do not respond to the use of oxygen in the hydrogen stream.

The advantages of employing oxygen are illustrated in Table 1, tabulated from comparable test runs showing the use of pure hydrogen, use of traces of air in the hydrogen, and use of 0.5% air in the hydrogen supply, the catalyst being regenerated molybdenum oxide on alumina (containing 5% silica). It will be noted that the wt.-% benzene per pass, using 0.5% air, is over twice as much as in the case where pure hydrogen is employed.

Table 1—Effect of Oxygen in Hydrogen Supply in Catalytic Aromatization

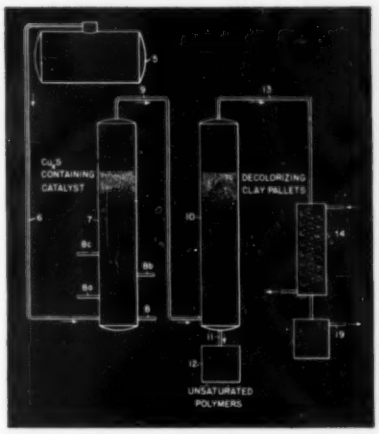
Hydrogen Supply	Pure Hydrogen		Trace of Air		0.5 vol.-% air	
Test Conditions:						
Temp., °F.	923	927	929	926	928	929
Pressure, psi	490	490	490	490	490	490
H_2/H C molal	12.8	12.3	12.9	13.9	13.4	13.8
L.S.V.	0.50	0.523	0.51	0.49	0.50	0.477
Liquid recovery, wt.-%	58.2	40.3	74.0	75.2	82.0	80.0
Recovery, wt.-%, average	49.3		74.6		81.0	
Benzene per pass, wt.-%	6.9	4.8	11.2	10.7	13.6	12.4
Benzene per pass, wt.-%, average	5.85		10.95		13.0	

New Method for Stabilizing The Color of Fuel Oils

A METHOD for reducing sedimentation and stabilizing the color of a distillate fuel oil boiling between 300° and 700° F by use of polyethylene glycol as a contacting medium is disclosed in the Socony-Vacuum Oil Co. Patent 2,650,187.

The invention involves treatment of the otherwise finished fuel oil with a small quantity of a high molecular weight polyethylene glycol, followed by separation of the oil from admixture with the glycol treating agent, to yield what is claimed to be a stabilized oil having an appreciably greater resistance to discoloration and sediment formation than the untreated oil.

The treating compounds are marketed in the trade as "Polyethylene Glycol 600," "Carbowax 1000," etc., the numerals representing the average molecular weight of the compounds. It is preferred to use a polyethylene glycol of at least 600 molecular weight in an amount of 2-25% by weight. A number of examples are given showing improvement in storage stability.



CATALYTIC OXIDATION process developed by Air Reduction Co. for desulfurization of distillates (U. S. 2,640,010)

Oxygen Aids Desulfurizing Of Petroleum Distillates

SULFUR compounds usually present in petroleum distillates are claimed to be removed readily by passing the vaporized distillate at 550°-950° F. over a catalyst in presence of oxygen. In its U. S. Patent 2,640,010, Air Reduction Co. specifies the most effective temperature to be 750°-850° F. The catalysts which may be used include cuprous sulfide and mixtures of cuprous sulfide with aluminum silicates, or alumina. Commercial oxygen of 99.5% purity or better is preferred.

It was found that the desulfurizing of a West Texas distillate containing 0.821% sulfur required no more than 1.25 cu. ft. of oxygen per bbl. The oxygen is added at several points throughout the catalyst bed intermittently to prevent overheating which tends to produce tars that soon would plug the catalyst.

The process employed is shown diagrammatically in the flow chart above. Hydrocarbon vapor from still 5 is delivered by pipe 6 to the bottom of catalyst tower 7. Oxygen is introduced into the tower through lines 8, 8a, 8b, etc., intermittently. The vapors, including SO_2 and other gases, escape through pipe 9 and are led to the bottom of column 10, which is filled with decolorizing clay in the form of pellets. Here, polymers and other heavier products are drawn off through line 11 into tank 12, while the treated vapors are taken overhead through line 13 and condensed in 14. Uncondensed gases are drawn off through pipe 19.

Percent sulfur removal by this

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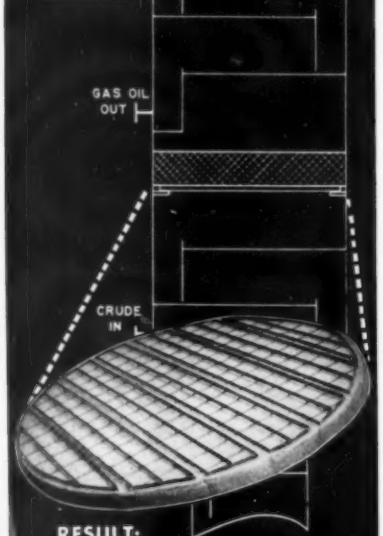

RESULT:
Cleaner gas oil with reduction in carbon and metals contamination which means increased yield of higher octane gasoline from your cat cracker.

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method is reported as 87% for gasoline, 70.3% for naphtha, 85.4% for kerosine and 60% for gas oil.

Patents Issued in December

The following classified listing gives the patent number, patentee, or assignee, and a brief description of all patents believed to be of interest to the petroleum processing industries, as contained in the Official Gazette of the U. S. Patent Office for December 1, 8, and 15, 1953, Vol. 677, Nos. 1-3.

PROCESSES

Refining

2,661,094 (Shell Development Co.) Variable volume separator for liquids.
2,661,266 (Standard Oil Co.-Ind.) Hydrogen fluoride-treating system.
2,661,317 (The Texas Co.) Separation of wax constituents and the like from oil, using urea.
2,661,362 (Standard Oil Development Co.) Removal of oxygenated organic compounds from hydrocarbons.
2,661,812 (Phillips Petroleum Co.) Process for separating a gaseous mixture by liquid absorption and distillation.
2,662,000 (Pure Oil Co.) Process for manufacturing sodium hydrosulfide solution from hydrogen sulfide.
2,662,041 (Sun Oil Co.) Process for removing sulfur from refining equipment.
2,662,042 (Sun Oil Co.) Process for removing scale from fractionating towers with aqueous cleaning solution.
2,662,049 (Superior Oil Co.) Recovery of hydrocarbons by refrigeration dehydration and oil absorption.
2,662,759 (Aubrey Keith Brewer) Multicellular fractionation column and the like.
2,662,843 (Shell Development Co.) Shale oil refining, using formic acid extraction.

Catalysts

2,662,063 (National Cylinder Gas Co.) Catalyst composition made by compressing at over 35,000 psi. mixture of iron oxide and chromium oxide.
2,662,860 (Shell Development Co.) Method for the production of molded alumina carrier and catalyst.
2,662,861 (M. W. Kellogg Co.) Platinum and palladium catalysts.

Conversions

2,661,320 (Sinclair Refining Co.) Catalytic reforming process using molybdena-alumina catalyst.
2,661,321 (Lummus Co.) Hydrocarbon conversion process and regeneration of fouled contact material utilizing flue gas and steam as the gas lift.
2,661,322 (Houdry Process Corp.) Process and apparatus for reacting gaseous media in the presence of hot contact material.
2,661,324 (Universal Oil Products Co.) Conversion of heavy hydrocarbonaceous materials in the presence of subdivided coke (fluid decoking?).
2,661,327 (David Dalin) Apparatus for the destructive distillation of oil shale.
2,661,384 (Phillips Petroleum Co.) Isomerization of C_4-C_{10} hydrocarbons with $AlCl_3$ on adsorbent.
2,662,003 (Phillips Petroleum Co.) Process for effective catalytic conversion of hydrocarbons using heated pebbles.
2,662,005 (Socony-Vacuum Oil Co.) Gaseous fuel production in coking operation.
2,662,006 (Socony-Vacuum Oil Co.) Gas manufacture, employing water gas, cracking and coking zones.
2,662,050 (M. W. Kellogg Co.) Catalytic cracking of heavy residual oils with hot regenerated catalyst.
2,662,051 (Sinclair Refining Co.) Catalytic cracking of heavy hydrocarbons.
2,662,091 (William W. Odell) Process and means of promoting chemical reactions with fluid solid stream.
2,662,103 (Phillips Petroleum Co.) Production of iso-paraffins from isopentane and olefins with HF.
2,662,813 (Standard Oil Development Co.) Regenerator apparatus for fluidizable solid materials.
2,662,816 (Hydrocarbon Research, Inc.) Gasification of carbonaceous materials containing volatile constituents, using fluidized bed.
2,662,844 (Universal Oil Products Co.) Conversion or cracking of light and heavy oil fractions in the presence of subdivided contact material.
2,662,845 (Shell Development Co.) Thermal cracking of heavy oils and separation process.
2,662,846 (Gulf Research & Development Co.) Destructive hydrogenation of heavy hydrocarbons.

Hydrocarbon Synthesis

2,661,270 (Phillips Petroleum Co.) Manufacture of synthesis gas by reacting methane with steam.
2,661,338 (Phillips Petroleum Co.) Regeneration of a Fischer-Tropsch reduced iron catalyst.
2,662,004 (The Texas Co.) Method of preparing synthesis gas at elevated pressures, using steam and CO_2.
2,662,007 (M. W. Kellogg Co.) Gasification of powdered caking type coal, using oxygen and steam.
2,662,090 (Standard Oil Development Co.) Hydrocarbon synthesis using fluidized catalyst.
2,662,749 (Hydrocarbon Research, Inc.) Annular flow recuperative heat exchanger.
2,662,911 (Metallgesellschaft Aktiengesellschaft) Temperature control in the catalytic hydrogenation of carbon monoxide.
2,662,912 (Standard Oil Development Co.) Hydrocarbon synthesis reaction.

PRODUCTS

Chemicals

2,661,319 (Standard Oil Co.-Ind.) Hydrogen fluoride purification.
2,661,339 (Jasco, Inc.) Blends of resinous styrene-conjugated diene copolymers and rubbery materials.
2,661,363 (Shell Development Co.) Peresters of peroxycarboxylic acids.
2,661,379 (Ethyl Corp.) 1,4-Dibromo-2,2,3,3-tetrachlorobutane.
2,661,380 (Socony-Vacuum Oil Co., Inc.) Oxidative dehydrogenation of cyclic hydrocarbons with tellurium oxide, etc.
2,661,381 (Universal Oil Products Co.) Dehydrogenation of a cycloolefinic hydrocarbon containing a geminal carbon atom to alkylaromatic.
2,661,382 (Standard Oil Co.-Ind.) Preparation of ethylxylenes.
2,661,383 (Sinclair Refining Co.) Process for producing benzene from C_6 cut.
2,662,080 (Shell Development Co.) Method for producing derivatives of hexahydropyrimidine and converting the same to 1,3-diamines.
2,662,086 (Standard Oil Co.-Ind.) Method of preparing hydrolytic condensation product of dichlorodipropyl sulfide in aqueous hydrogen chloride and condensation product resulting therefrom.
2,662,097 (Ethyl Corp.) Condensation process for reacting epoxide with ethanolamine.
2,662,100 (Ethyl Corp.) Purification of sodium alcoholates.
2,662,102 (E. I. du Pont de Nemours & Co.) Preparation of cyclohexene from ethylene and butadiene.
2,662,847 (Stanolind Oil and Gas Co.) Method for distillation of cyclopentanone from 2-methyl-1-butanol and 3-methyl-1-butanol.
2,662,848 (Standard Oil Development Co.) Extractive distillation purification of acetone.
2,662,862 (Phillips Petroleum Co.) Drying resins from oil-modified alkyds and liquid polybutadiene.
2,662,869 (Universal Oil Products Co.) Vulcanized composition formed from sulfur, rubber, and an alkenyl phenol for joining metal, wood, glass, and thermosetting resins.
2,662,879 (Shell Development Co.) Separation of geometrical isomers by urea complex formation (oleic acid separation).
2,662,900 (Socony-Vacuum Oil Co., Inc.) 3-thienyl thioethers.
2,662,917 (Continental Oil Co.) Production of thionophosphorus compounds.
2,662,921 (Socony-Vacuum Oil Co., Inc.) Catalyst and method for selective oxidation of propylene to acrolein.
2,662,923 (Dresser Operations, Inc.) Oxidation of aromatic hydrocarbons to phenols, using SO_2.
2,662,924 (Ethyl Corp.) Dehydrochlorination of polychlorocyclohexanes with sulfonic acid catalyst.
2,662,925 (Standard Oil Co.-Ind.) Isomerization of xylenes with HF.
2,662,926 (Standard Oil Co.-Ind.) Pentamethylbenzene disproportionation (using HF).

(To obtain more data on advertised products see page 276)

Fuels

2,661,054 (Coleman Co., Inc.) Apparatus for vaporization and combustion of hydrocarbon distillates.
2,661,062 (Harald Edholm) Container for storing oil underground.
2,661,195 (Shell Development Co.) Method and apparatus for atomizing liquids.
2,661,243 (Phillips Petroleum Co.) Viscosity-compensating variable-area fuel nozzle.
2,661,271 (Coleman Co., Inc.) Vaporization and combustion process for hydrocarbon distillates.
2,661,361 (Ethyl Corp.) Manufacture of tetraethyllead.
2,662,379 (Otto Reich, et al.) Storage device for liquefied gases and the vapors thereof.
2,662,817 (Standard Oil Development Co.) Jet turbine engine fuel, including methanol and isopropanol.

Lubricants

2,661,318 (Standard Oil Co.-Ind.) Trough greases.
2,661,335 (Monsanto Chemical Co.) Lubricating grease containing soap and alkylated polystyrene.
2,662,055 (The Texas Co.) Non-foaming oil compositions containing silicone polymer.
2,662,056-7 (Gulf Research & Development Co.) Lubricating compositions (bentonite-nitrogen base grease).
2,662,058 (Gulf Research & Development Co.) Thixotropic petroleum lubricating jelly made of wax, bentonite-nitrogen base, etc.
2,662,059 (Gulf Research & Development Co.) Lubricating compositions (bentonite-nitrogen base-dibasic acid ester grease).
2,662,068 (General Mills, Inc.) Organic solvent gels, containing hydrocarbon and polyamide gelling agent.
2,662,815 (Standard Oil Development Co.) Oxidation inhibitor (N-nitroso diphenyl amine).
2,662,856 (Tide Water Associated Oil Co.) Mineral oil compositions (p-s compounds, inhibited).

Specialties

2,661,296 (Shell Development Co.) Rust-inhibiting composition containing wax, lead naphthenate and aromatic solvent.
2,661,300 (The Texas Co.) Asphalt cutbacks containing naphtha and silicone polymer to reduce naphtha evaporation.
2,661,301 (Gulf Research & Development Co.) Compositions comprising bentonite-organic amine compounds in asphalts, tars, or pitches.
2,661,302 (The Texas Co.) Process of preparing dense plastic compositions of asphalt and asbestos.
2,661,323 (Lummus Co.) Asphalt blowing.
2,661,377-8 (Shell Development Co.) Process for halogen exchange in insecticides.
2,662,030 (Standard Oil Co.-Ind.) Briquetting asphalt compositions.
2,662,808 (Shell Development Co.) Corrosion-inhibiting sheet-packaging material with nitrobenzaldehydes.
2,662,858 (Standard Oil Development Co.) Stabilizing hypochlorite solutions with K dichromate.

Miscellaneous

2,660,858 (Socony-Vacuum Oil Co., Inc.) Air-cooling gas turbine blade.
2,660,885 (The Texas Co.) Recording viscosimeter.
2,660,886 (Shell Development Co.) Pneumatic speed-sensing unit.
2,660,996 (Petro-Chem Process Co., Inc.) Fluid heater.
2,661,768 (Standard Oil Development Co.) Indicating orifice plate for threaded orifice union.
2,661,798 (Standard Oil Development Co.) Flare stack, pilot burner, and pilot igniter.
2,661,938 (Standard Oil Co.-Ind.) Electromagnetic stirrer for high-pressure contactors.
2,662,393 (Standolind Oil and Gas Co.) High-pressure windowed cell.
2,662,408 (Pure Oil Co.) Electronic pressure indicator.

EQUIPMENT

Processing, general

2,660,996 (Petro-Chem Process Co.) Fluid heater.
2,661,093 (Alton L. Sawyer) A process for discharging, with minimum loss of oil, some of the contents from the bottom of a tank.
2,661,094 (Shell Development Co.) Variable volume separator for liquids.
2,661,190 (Stone & Webster Engineering Corp.) A vapor-to-liquid heat exchanger.
2,661,195 (Shell Development Co.) Method and apparatus for atomizing liquids.
2,661,325 (Harry K. Savage) Method and apparatus for extracting volatile constituents from carbonaceous materials.
2,661,327 (David Dalin) Apparatus for the destructive distillation of oil shale.
2,661,938 (Standard Oil Co.-Ind.) Electromagnetic stirrer for high-pressure contactors.
2,662,749 (Hydrocarbon Research, Inc.) Annular flow heat exchanger.
2,662,850 (Lummus Co.) Condensing system for distillation column.

Instruments

2,660,834 (California Institute Research Foundation) Pressure regulator.
2,660,885 (The Texas Co.) Recording viscosimeter.
2,660,886 (Shell Development Co.) Pneumatic speed-sensing unit.
2,661,260 (American Cyanamid Co.) Multiple range recorder.
2,661,577 (Thomas A. Hanson) Automatic pressure changer for gas regulators.
2,661,578 (Rockwell Mfg. Co.) Fluid pressure regulator.
2,661,625 (Pressure Gauges, Ltd.) A gage connection for connecting a pressure gage to a gas pressure system.
2,661,626 (Archibald R. Moffett) Fluid pressure gage.
2,661,754 (Hagan Corp.) A device for developing fluid pressures that vary in magnitude as a function of a pressure differential.
2,661,757 (Fluid Systems, Inc.) Control apparatus for dividing fluid flow mechanisms.
2,661,893 (Ingersoll-Rand Co.) Control device for fluid compressors.
2,661,897 (The Texas Co.) Electrical analogue.
2,662,394 (Republic Flow Meters Co.) Apparatus for measuring the density of gases.
2,662,408 (Pure Oil Co.) Electronic pressure indicator.
2,662,409 (F. W. Dwyer Mfg. Co.) Flexible, portable manometer.
2,662,985 (Diamond Power Specialty Corp.) Radiation-absorption-type liquid level indicator.

Pumps & Compressors

2,660,956 (Waterous Co.) Priming arrangement for centrifugal pumps.
2,660,958 (Borg-Warner Corp.) Pressure-loaded gear pump.
2,661,698 (Christopher A. Schellens) Centrifugal pump.
2,662,481 (Gilbert & Barker Mfg. Co.) Priming means for centrifugal pumps.
2,662,483 (Thompson Products, Inc.) Rotary vane pump.
2,662,484 (Robert L. Eller) Hydraulic pump or motor.

Valves & Fittings

2,661,013 (Robertshaw-Fulton Controls Co.) Diaphragm valve control.
2,661,023 (Clayton Mfg. Co.) Fluid pressure-operated valve.
2,661,136 (Shell Development Co.) Automatic shut-off liquid-dispensing nozzle.
2,661,243 (Phillips Petroleum Co.) Viscosity-compensating variable-area fuel nozzle.
2,661,963 (Standard Oil Development Co.) Expansion joint.
2,662,543 (New York Air Brake Co.) Pressure-reducing and relief valve.
2,662,550 (Louis C. Meyer) Valve for controlling fluid flow by variation in electric current.
2,662,554 (Grover C. Singer) Valve.

Catalysts

2,661,322 (Houdry Process Corp.) Process and apparatus for reacting gaseous media in the presence of hot contact material.
2,662,796 (Houdry Process Corp.) Apparatus for elevating granular material.
2,662,813 (Standard Oil Development Co.) Regenerator apparatus for fluidizable solid materials.

How to Obtain Patents

Readers may obtain copies of any U. S. Patent from the Patent Office at 25¢ each. Order by patent number direct from the Commissioner of Patents, Washington 25, D. C.

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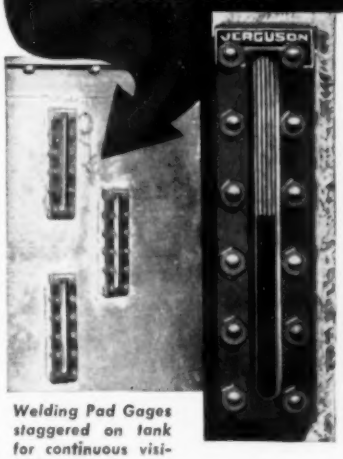

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These Special Gages follow Jerguson Standard Gages in general design and materials, except for the method of attaching. The chamber of the gage consists of a bar steel pad which is welded to the vessel.

Welding Pad Gages are made in both Reflex and Transparent types . . . in all sizes of Jerguson Standard Gages. Pressure ratings are available to your specific requirements. Welding pad may be of any metal desired to withstand corrosive or other conditions.

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KR 54-12

Atlantic Executive Given Chemists' Award

Hugh W. Field, center, vice-president and director of the research and development department of the Atlantic Refining Co., is shown receiving the honor scroll given annually by the Pennsylvania Chapter of the American Institute of Chemists. Dr. Lincoln Work, left, president of the Institute, makes the award while Dr. Walter Thomas, chairman of the Pennsylvania Chapter, looks on. The occasion was a recent meeting of the chapter in Philadelphia, Pa.

Eugene Holman has been elected chairman of the board of directors of the Standard Oil Co. of New Jersey. **M. J. Rathbone** has been moved up to the president's post, replacing Mr. Holman, and also made vice-president of the executive committee. Mr. Holman, who remains the chief executive officer of the company and chairman of the executive committee, has been president since 1944. Mr. Rathbone has been a director since 1949.

Further promotions in the company are **Chester Smith,** a vice-president and director, to the executive committee, and **Lloyd W. Elliott,** a director, to the post of vice-president, succeeding **Orville Harden,** who retired after 43 years of service. In addition, **Peter T. Lamont** and **Howard W. Page** have joined the company's board.

Mr. Holman, as the new board chairman, succeeds **Frank W. Abrams,** who has retired. Mr. Holman joined Humble Oil & Refining Co. in 1919 and later served as president and director of Creole Petroleum Corp. and Lago Petroleum Corp., Venezuelan affiliates of Jersey Standard.

He was named a director of the New Jersey firm in 1940, elected a vice-president in 1942, and subsequently became a member of the executive committee. He took over the presidency of the company in 1944, and in 1946 became chairman of the executive committee.

Mr. Rathbone joined Standard of New Jersey 32 years ago as an engineer at the Baton Rouge refinery of Standard Oil Co. of Louisiana. He rose to become general superintendent of that plant and later became president of Louisiana Standard. In 1944, when the Louisiana company was merged with Esso Standard Oil Co., he came to New York as president of Esso Standard, a post he held until he moved to the parent company as a director in 1949.

Mr. Smith was elected to the board of Standard of New Jersey in 1944 and became a vice-president two years later. Mr. Elliott was president of Standard-Vacuum Oil Co. when he was elected to the New Jersey firm's board in 1951. Mr. Lamont, with the New Jersey organization since 1922, has been the company's overall marketing coordinator for four years. Mr. Page, an employee of New Jersey Standard for 24 years, has been executive assistant to the president since 1947.

O. M. Williams, assistant to the vice-president of Shell Chemical Co., has been appointed manager of the company's plant at Dominguez, Calif., succeeding **Glenn Purcell,** who has been shifted to the manager's post at the Houston, Tex., plant.

Mr. Williams joined Shell in 1935 at Martinez, Calif., and later worked at Dominguez and Houston before his assignment in 1951 as assistant to the vice-president.

H. E. Handy has been appointed to the newly established position of manager of the Ohio Oil Co.'s Robinson, Ill., refinery. He has had 30 years with the Ohio company, most of it at the Robinson refinery, where for the past seven years he has been the superintendent.

D. L. Winsett, formerly assistant refinery superintendent at Robinson, has replaced Mr. Handy. Mr. Winsett joined the Transcontinental Oil Co. in 1925, and when that firm was purchased by the Ohio Oil Co. he continued as a chemist at the Del Rio, Tex., refinery. He was later transferred to the Bristow, Okla., refinery and became the superintendent there in 1936. In 1939 he was made assistant superintendent at Robinson.

George R. Monkhouse, vice-president of Shell Chemical Co., has been made the head of Shell's newly created ammonia division and will establish headquarters in San Francisco.

The company's two new ammonia plants on the west coast, at Pittsburg,

Mr. Monkhouse

Mr. Roberts

Calif., and Ventura, Calif., have been put under the direction of **L. M. Roberts,** recently appointed operations manager of the ammonia division and general manager of manufacturing for that corporation.

R. F. Davis, assistant to the director of research, Universal Oil Products Co., has retired, ending almost 37 years of service in the oil industry. Before joining Universal in 1929 he spent 16 years with several California oil companies. He was a member of Universal's field group briefly, being assigned to the patent department in 1930, where he remained until 1943. In that year he was made an assistant

to Dr. Gustav Egloff, the director of research.

Members of the Davis family have been connected with the oil industry since 1859, and Mr. Davis' son, a consulting petroleum geologist, is expected to maintain this tradition.

Mr. Davis is an active member of the American Chemical Society and the Institute of Chemists. He and his wife will make their retirement at their present home in Palatine, Ill.

Samuel Messer was recently elected chairman of the board of the Quaker State Oil Refining Corp., Oil City, Pa., succeeding **Harry J. Crawford,** who died the past November. Mr. Messer has been with the company for more than 50 years and has served the company as vice-president, president and vice-chairman of the board.

Kenneth H. Klipstein has been appointed general manager of the newly created research division of American Cyanamid Co. This division will be responsible for the operation of the Stamford Research Laboratories under the direction of **Dr. J. T. Thurston.** It will also supervise other research and development programs which are not the direct responsibility of operating divisions and will coordinate these programs with related activities of the operating divisions.

Mr. Klipstein

Mr. Thurston

Mr. Duncan

Mr. Atkins

Another new unit of American Cyanamid is the organic chemicals division. **L. C. Duncan** has been named general manager of this division and **V. E. Atkins,** assistant general manager. The organic chemicals division will merge and consolidate the activities of the petrochemicals division with those of the Calco chemical division.

S. R. McMurry, manager of Cities Service Oil Co.'s Ponca City, Okla., refinery, has been transferred to the Bartlesville headquarters on special assignment. **D. R. McConnohie,** of Bartlesville, now assistant to the general superintendent of refining, will assume Mr. McMurry's duties as manager of the Ponca City refinery.

Mr. McMurry joined Cities Service in 1924 and was transferred to Ponca City in 1950, after serving 20 years in various operational and supervisory positions at the company's East Chicago, Ind., refinery. Mr. McConnohie joined Cities Service at its East Chicago refinery in 1936 as pressure-still operator and advanced through various positions to head the plant's cracking department. He was transferred to Bartlesville in 1951 as assistant to the general superintendent.

Charles S. Jones, president of Richfield Oil Corp., has been elected president of the Western Oil and Gas Assn., succeeding **L. L. (Red) Aubert,** president of Bankline Oil Co.

Mr. Jones was president of the association in 1934 and 1935 when he was president of Rio Grande Oil Co. and the association was known as the California Oil and Gas Assn. In 1937 he became president of Richfield when it was reorganized and Rio Grande became one of its divisions. Last November, Mr. Jones was elected vice-president in charge of the transportation division of the American Petroleum Institute.

Other officers of the Western Association elected were **John W. Hancock,** president of Hancock Oil Co., first vice-president; **Lowell Stanley,** chairman of the board of Monterey Oil Co., second vice-president; **William Reinhardt,** vice-president of Union Pacific Railroad Co., treasurer, and **Felix Chappellet,** secretary and acting manager.

New board members are **B. E. Devere,** president of Pathfinder Petroleum Co., and **R. R. Von Hagen,** president of Lloyd Corp., Ltd.

Paul E. Kuhl, who has been in a government post in Washington for the past year, has returned to Esso Standard Oil Co. as an assistant general manager of manufacturing. The company now has two assistant general managers of that department, one of them, **William F. Thiede,** took it over when Mr. Kuhl left for his government assignment and will retain the post.

Kenneth Boldt, Pure Oil Co., Crystal Lake, Ill., was elected vice-president of the Society of Automotive Engineers' fuels and lubricants division at the annual business meeting, held January 12 at Detroit, Mich.

Mr. Boldt

Mr. Boldt has been director of the engine and fuels division of Pure Oil's research and development laboratory since 1952. He joined the company after receiving his bachelor's degree in chemistry from Elmhurst College, Elmhurst, Ill., in 1936. In 1946 he became section supervisor of automotive and machine testing in the production development department.

The SAE elected William Littlewood, vice-president for engineering of American Airlines, Inc., president for 1954.

Herschel Y. Hyde has been promoted to vice-president in charge of manufacturing for the western division of Tide Water Associated Oil Co. In this post he has responsibility for planning and developing programs for the entire company's refining work, including research.

Mr. Hyde is a graduate of the University of California and the Massachusetts Institute of Technology. He has been with Tide Water Associated for 26 years, beginning as a research chemist in the company's refinery at Avon, Calif. He served in various positions in the research and development department and became supervisor of that department in 1929. Since 1946 Mr. Hyde has served as vice-president in charge of manufacturing, western division.

In his newest post he will continue to make his headquarters at San Francisco.

P. M. Johnson, Jr., (B.A. in chemistry, University of Texas) **H. D. Ledbetter** (Ph.D. in organic chemistry, University of Tennessee) and **J. C. Smith** (Ph.D in organic chemistry, University of Texas) have joined Dow Chemical Co.'s Texas Division organic laboratory at Freeport as chemists. **R. E. Thompson** (B.S. in chemical engineering, Oklahoma A. & M. College)

has been employed as a production development engineer in the student training program.

Dr. William J. Sparks, co-inventor of Butyl synthetic rubber, will receive the 1954 gold medal of the American Institute of Chemists at the organization's annual meeting in May. Dr. Sparks is the director of the chemical division and coordinator of exploratory research for the Standard Oil Development Co.

Mr. Sparks

He received his B. A. and M. A. from the University of Indiana and his Ph.D. in chemistry from the University of Illinois. He joined the Standard Oil Development Co. in 1936, and some of his most important work was done during the last part of that decade and the beginning of the next.

The development of Butyl rubber, the iso-butylene-isoprene low temperature copolymer, introduced to the American chemical industry a radical departure in commercial operations—a continuous polymerization conducted at —110 degrees F. in large-scale equipment.

Among the other polymers of note which he developed in the late '30's and early '40's were two types which were later to assume commercial importance. There were "T-132," a high-styrene-isoprene emulsion copolymer, a forerunner of the artificial leather and shoe-sole type resins of present importance. Another was a thermoplastic film-forming copolymer of isobutylene and styrene of low temperature origin known as "S-Resin." This is considered to offer significant practical promise and is now in the semi-commercial stage.

Earl K. Dewey has been promoted by Continental Oil Co. from resident engineer at the Denver, Colo., refinery to resident engineer at the Lake Charles, La., plant. The assistant resident engineer at Lake Charles, **Roger M. Haynes,** will succeed Mr. Dewey as resident engineer at Denver.

Sam H. Casey, formerly general manager of purchases, Pan-Am Southern Corp., has been promoted and given the title of general manager of supply and transportation as part of a company reorganization which merges the activities of his former post with the supply and transportation department. With the reorganization the departments of traffic, crude oil supply, product supply and exchange, purchasing and aviation are grouped under the supply and transportation department.

Also in conjunction with the new arrangement, **L. F. Andry,** formerly assistant traffic manager, has become traffic manager.

Harry A. Jackson has been appointed a vice-president and chairman of the operating committee, eastern division, Tide Water Associated Oil Co. Mr. Jackson has been with the company for more than 30 years, beginning as a plant clerk in the sales department in California. Since 1947 he has served as president of Seaside Oil Co., a California subsidiary of the Tide Water firm.

G. A. Davidson, vice-president of Standard Oil of California in charge of manufacturing, has been made a director of the company. He succeeds **B. W. Letcher,** who is retiring as a vice-president and director after 43 years with the company.

Carl M. Fabian has been made general superintendent of Magnolia Petroleum Co.'s Beaumont refinery, succeeding **J. L. Heath,** who retired after almost 39 years of service with the company. Mr. Fabian has been employed at the Beaumont plant since he joined Magnolia in 1919, a week after his graduation from Texas A. & M. College with a bachelor's degree in chemical engineering.

Mr. Fabian

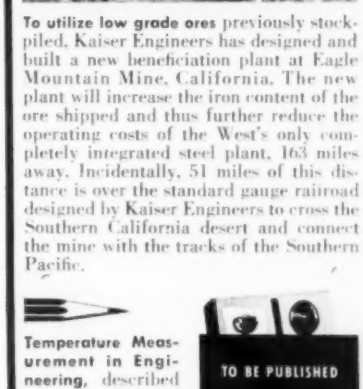
Mr. Heath joined the company as a boilerhouse fireman in 1915. Gradual promotion led to his becoming general superintendent of the Beaumont refinery in 1947.

Another post vacated by retirement was filled with the appointment of **N. B. Marchbanks** as superintendent of the Ft. Worth, Tex., refinery. He is replacing **J. W. Folmar,** who was superintendent for nearly 15 years.

Mr. Marchbanks joined Magnolia in 1916 at Dallas and was eventually transferred to the Ft. Worth refinery as assistant superintendent. His successor in that post at Ft. Worth is **J. D. Wall,** who was formerly assistant

what's NEW in Engineering

A triple threat fire truck to fight oil field fires is reported to have been perfected by the Seagrave Corporation of Columbus. Unlike ordinary fire-fighting apparatus, the new truck is designed to snuff out oil field and refinery fires any one of three ways: by squirting out 2800 gallons of water a minute, 1300 pounds of dry chemical compounds, or 19,000 gallons of fire-smothering "foam". In an emergency, all controls on the 20,600 pound unit can be operated by one man.



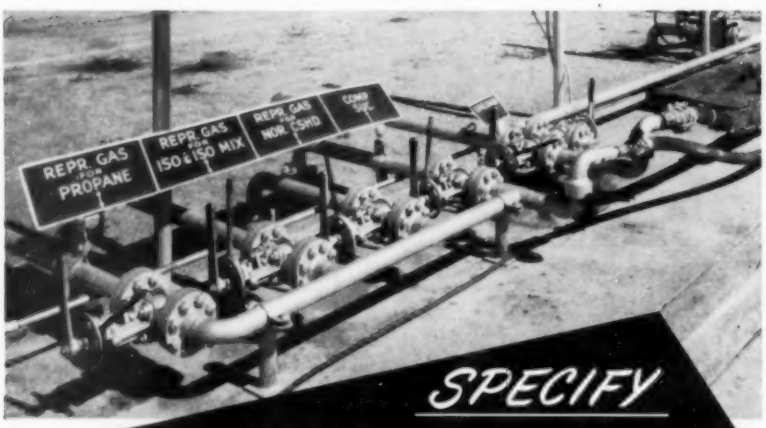
To utilize low grade ores previously stockpiled, Kaiser Engineers has designed and built a new beneficiation plant at Eagle Mountain Mine, California. The new plant will increase the iron content of the ore shipped and thus further reduce the operating costs of the West's only completely integrated steel plant, 163 miles away. Incidentally, 51 miles of this distance is over the standard gauge railroad designed by Kaiser Engineers to cross the Southern California desert and connect the mine with the tracks of the Southern Pacific.

Temperature Measurement in Engineering, described as a "how to" book for the proper design, performance, and operation of temperature measurement installation, has just been published by Wiley. The authors of the new book are H. Dean Baker, E. A. Ryder and N. H. Baker.

Kaiser Engineers has a large staff of engineering and construction experts ready to tackle your problems in all fields of design, engineering and construction. Call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

 (To obtain more data on advertised products see page 276)

for dependable, trouble-free control
"of hard-to-hold" fluids . . . . .



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A positive, drop-tight seal and instant, stick-proof operation under all fluid, temperature or pressure conditions, is assured by the exclusive, built-in, Homestead Lever-Seald mechanism. This powerful lever-and-screw device not only presses the valve's tapered plug firmly into its seat to form a drop-tight seal, but also provides a positive means of relieving seating pressure just enough to overcome friction and permit easy operation. And because all operating parts and valve seating surfaces are fully protected in both the open and closed positions from the corrosive or erosive effects of line fluids, long, dependable, trouble-free service is doubly assured.

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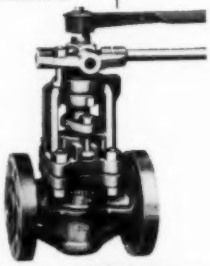
We make them in metals and alloys to specification in sizes 1½" to 12", for pressures from vacuum to 1500 lbs., and for temperatures from 40° below zero to 1100°F. Dry seat, or pressure gun lubricated optional.



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to the mechanical superintendent at Magnolia's Beaumont refinery. Mr. Wall was first employed by Magnolia in 1946, in the Beaumont plant's technical department. He became assistant to the mechanical superintendent in June, 1953.

Mr. Folmar retired after more than 41 years of service with the company. From 1912 to 1936 he was at the Beaumont refinery, working his way up from a pipe fitter helper to assistant general foreman. He was promoted to superintendent of the Corsicana plant in 1936, returning to Beaumont when the Corsicana works discontinued operations. In 1939 he became the superintendent of the Ft. Worth refinery.

W. G. Copeland has been appointed general superintendent of the Port Arthur, Tex., works of The Texas Co. It was at this refinery that Mr. Copeland first joined Texaco, having been employed there in 1926 as a helper in the laboratory and as a chemist after his graduation from Rice Institute one year later.

Mr. Copeland

He advanced through various posts in the refining department and was transferred to New York in 1934, to a Texaco affiliate in France in 1939, to the San Antonio refinery in 1941, and to the Sunburst, Mon., refinery in 1943 as superintendent. In 1950 he became superintendent of the Eagle Point works at Westville, N. J.

Mr. Copeland's promotion has caused shifts in the assignments of four other Texaco men. **E. W. McNealy,** who was assistant superintendent of the Lockport, Ill., works, has become superintendent of the Eagle Point operations. His post, in turn, has been assumed by **J. C. Williams,** whose former position as assistant superintendent of the West Tulsa, Okla., works has been given to **F. D. Davis. V. K. Brandenburg,** formerly supervisor of operations at the Lawrenceville, Ill., plant, has become the new assistant superintendent of the Casper, Wyo., installation, replacing Mr. Davis.

Dr. James S. Cross has been made manager of the statistical research division of Sun Oil Co., Philadelphia, Penna.

HUDSON Solo-aire UNITS

FOR OIL REFINERY PROCESS COOLING

In this modern South Texas Refinery 80% of the unrecovered heat from the topping unit is dissipated directly to the air thru Hudson Solo-aire exchangers. The use of Solo-aire units for air-cooling all streams leaving the topping unit, including residuum at about 600° F, obviates the circulation of about 7000 gallons per minute of cooling water, and eliminates maintenance expense due to scale deposition and corrosion usually encountered in water cooling of high temperature streams.

Units pictured below are used for condensing and cooling

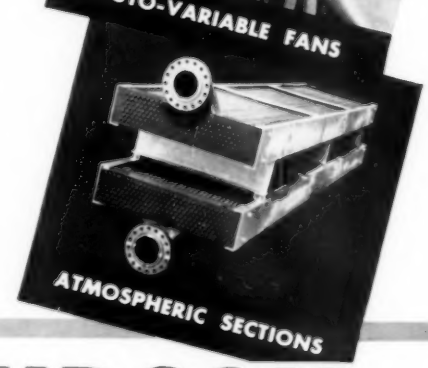
GASOLINE
NAPHTHA
KEROSENE
BURNING OIL
GAS OIL
RESIDUUM

Hudson Solo-aire units, equipped with HUDSON HY-FIN bimetal tubes are designed for refinery services, incorporating features to assure uninterrupted performance with low operating and maintenance costs.

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

HUDSON Top Performance COOLING EQUIPMENT

For more than two decades HUDSON personnel have developed equipment for heat recovery and heat dissipation. Present day HUDSON cooling equipment has been evolved through the years by constant improvements in design and fabrication.



COOLING TOWERS

Beauty and utility have been successfully combined in the HUDSON "TP" design. These Top Performance cooling towers embodying new but proven advancements in water cooling design, result in lower installation and operating costs for a given guaranteed performance.

SOLO-AIRE EXCHANGERS

HUDSON Solo-aire exchangers for jacket water cooling, gas cooling, steam condensing and hydrocarbon vapor condensing have found wide use, particularly where suitable cooling water is impossible or expensive to obtain. Even where adequate quality and quantity of water is available there are conditions under which these units have marked advantages over alternative cooling methods. Designs are available for pressures up to 5,000 pounds per square inch.

COMBIN-AIRE UNITS

By combining in one structure Solo-aire units with a cooling tower, HUDSON originated the Combin-aire unit. In hot weather, air before use in the Solo-aire units, is contacted with water to reduce both air and water temperature. In cold weather, water use is unnecessary. This device makes possible the use of air for low temperature cooling, allows use of untreated water, minimizes water consumption, and results in capital and operating savings.

AUTO-VARIABLE PITCH FANS

The latest in a long list of Hudson innovations. The auto-variable pitch fan controls cooler outlet temperature through automatic change in fan blade pitch, which in turn changes air volume across cooler tubes. Outlet temperature is closely controlled, and in a typical case horsepower consumption over the year is reduced seventy percent as compared with fixed pitch fan operation.

ATMOSPHERIC SECTIONS

These units are for use where water serves as cooling medium. They may be mounted vertically or horizontally, under cooling tower or submerged in water.

UNDIVIDED RESPONSIBILITY—***Complete integration of facilities in selection, design and manufacture of cooling towers, water cooled atmospheric sections, and air cooled exchangers results in cooling systems of minimum first cost, minimum operating cost, and in undivided responsibility.***

HUDSON
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Chemical Engineers Elect

Chalmer G. Kirkbride, president and director of the Houdry Process Corp., Philadelphia, Pa., has been elected president of the American Institute of Chemical Engineers for 1954. He was installed at the Institute's award banquet, held during each annual meeting.

Mr. Kirkbride

Mr. Kirkbride was educated at the University of Michigan, where he was awarded an M.S.E. in 1930. He has been with the Houdry Process Corp. since 1947 and its president since 1952. He is the author of the book, "Chemical Engineering Fundamentals," and has taken out a number of patents for research done in the petroleum industry.

Also installed at the banquet were the group's new vice-president, treasurer and secretary. They are, respectively, Barnett F. Dodge, head of the chemical engineering department at Yale University, New Haven, Conn.; George Granger Brown, dean of the University of Michigan, Ann Arbor; and Stephen L. Tyler, who was re-elected to the secretary's post.

New Emery Research Center

An $800,000 research center is being constructed by Emery Industries, Inc., adjacent to the firm's plant in Cincinnati, Ohio. The building will provide new and larger quarters for the departments of basic research, development and chemical engineering. The new 2-story building will allow expansion of Emery's research facilities to accommodate approximately 100 persons. It is being constructed of brick and will contain 30,000 sq. ft. of space.

The center is being built in two "wings," one of which will house 28 individual laboratories and several "application" laboratories in the basement. Equipment in the latter rooms is designed to evaluate on a "plant" scale all of Emery's fatty acids, plasticizers and textile oils in such end-use applications as plastics, textiles, alkyd resins, lube oils and greases, and metal working oils.

The other wing will contain the research executive offices, library and conference rooms. Construction is expected to be completed in late 1954.

Produce Brass Oil Equipment

Brass valves, fittings and accessories for the oil industry are now being produced by the Enterprise Brass Works, Muskegon, Mich., and marketed by the firm's newly established oil equipment sales division. The Enterprise company plans development of additional products for use in oil and allied industries.

Hold Spray Painting "School"

Regular painting as the most effective means of corrosion control was the topic of a 2-week training program recently given to 90 painters at refineries and chemical plants in Texas and Louisiana by Frank Foust, customer service division, DeVilbiss Co.

Mr. Foust worked with Sline Industrial Painters, a firm which contracts for the painting of refinery and chemical installations. The course was given in the techniques of "maintenance" painting with spray equipment and consisted of both on-the-job and classroom work.

Swartwout Shifts Sales' Office

The Los Angeles district office now handles all sales and service matters pertaining to the Swartwout Co.'s Autronic control and power plant equipment divisions, including special accounts previously held by Charles P. Crowley.

The office is under the direction of Roger R. Gilliland and is located at 317 West Main St., Alhambra, Calif. It services southern California, Arizona, and Clark County, Nevada.

Gil Moore & Co., agents for the Swartwout Co.'s industrial ventilating division, will continue to maintain offices at 714 West Olympic Blvd., Los Angeles 5.

Cooper-Bessemer Expands

Expanded field service facilities are housed in a 1-story brick building recently constructed by Cooper-Bessemer at Odessa, Tex. The structure houses 1715 sq. ft. of office space and 3725 sq. ft. of warehouse area. Serving the warehouse facilities is a 2-ton traveling crane for expediting delivery of heavy engine and compressor parts to the Texas area.

Standard Opens Sales' Unit

In recognition of the increasing need for sales technical service in the petrochemicals field the Standard Oil Development Co. has established a new laboratory unit, called the Enjay Laboratories Division. The unit will be responsible for work on petroleum additives, solvents, chemicals and polymers which are marketed nationally by the Enjay Co., Inc., a Standard affiliate. The new division will also conduct laboratory studies designed to meet the needs of Enjay clients.

Dr. Miller W. Swaney has been appointed director of the laboratory unit. He has served since 1947 as assistant director of Standard's Chemical Division, at Linden, N. J. Laboratory facilities for the new division also will be located in the Linden area.

Dr. Swaney joined Standard Oil Development Co.'s Chemical Division in 1939. He holds more than 35 patents and is the author of three scientific books. He served as chairman of the American Chemical Society's symposium on petrochemicals last September in Chicago.

Rockwell Promotes Kentler

Dr. Charles J. Kentler, Jr., manager of refinery and chemical sales, Rockwell Manufacturing Co., has been named technical consultant for the entire Meter and Valve Division.

Mr. Kentler

Dr. Kentler joined Rockwell in 1950 after three years as assistant plant manager of the chemical division of Wallace and Tiernan, Inc. Before that he had spent seven years as chemical and development engineer for Congoleum-Nairn, Inc., Tidewater Associated Oil Co. and Tennessee-Eastman Corp.

He is a chemical engineering graduate of Yale University, and he received his Ph.D. degree in chemical engineering from Cornell University.

Chart "Problem" Group Formed

A special engineering staff has been formed by Technical Charts, Inc., Buffalo, N. Y., to develop for industry or instrument makers charts which can be used with instruments that are not standard or in unusual applications with standard instruments.

Along with the increase in recording techniques has gone the demand for charts for new uses; thus the need for special facilities, the company says.

Selas Opens Subsidiary

Selas Constructors, Inc., Houston, Tex., is the new subsidiary of the

NOW

Roll tubes into thick tube sheets automatically! . . . from the inside out! with the

NEW AIRETOOL RETRACTIVE EXPANSION SYSTEM

Advantages? just check them!

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With this new Retractive Method of Tube Expansion, the expander is fully inserted and rolls a short section of the tube. When full expansion is reached, it then automatically starts to retract. Keeps rolling as it retracts, gives full expansion to the tube the entire thickness of the sheet.

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Representatives in principal cities of U.S.A., Canada, Mexico, South America, England.

Selas Corp. of America, Philadelphia, Pa., processing engineers and manufacturers for industry. The company acquired the Clare Construction Co., Houston, as the nucleus of the new subsidiary and employed R. T. Clare, Jr., as its general manager and vice-president.

The purpose of the new firm is to facilitate fabrication, erection and service of the Selas Corp.'s designs and developments for the petroleum and petrochemical industries of the southwest.

K. W. Fleischer, manager of the fluid processing division of the parent company, is responsible for designs as the engineering vice-president of the subsidiary.

Monsanto Chemical Promotes

Monsanto Chemical Co. has announced the election of four division general managers as vice-presidents and the appointment of two regional vice-presidents.

The division general managers elected were Roy L. Brandenburger and Edward O'Neal, Jr., of St. Louis; Robert K. Mueller, of Springfield, Mass.; and Charles H. Sommer, Jr., of Washington, D. C.

The new regional vice-presidents are Edward W. Gamble, Jr., of Washington, D. C., and Victor E. Williams, of New York City.

Fram Buys Warner Lewis

The Fram Corp., Providence, R. I., has purchased the Warner Lewis Co., Tulsa, Okla., manufacturers of liquid fuel separators, filters and meter calibrating tanks, it was recently announced.

The subsidiary will be known as the Warner Lewis Co., Division of Fram Corp., and will continue operations at its Tulsa headquarters. The parent organization will continue to market the Warner Lewis "Excelso type" liquid separator, as well as its own "interfacial tension" type of unit. The liquid separator division of Fram will be transferred to the Warner Lewis Co. in Tulsa within the next few months.

Personnel Changes

Combustion Control Corp.—Arne Lovendahl to manager of the Philadelphia area office from sales engineer in the Chicago area.

Rockwell Mfg. Co. — Orville W. Barnett to valve products manager; Gilbert T. Bowman to newly created

post of manager, product department, Meter and Valve Division.

Gates Engineering Co. — Dr. G. Karl Vogelsang to technical director in charge of leading and coordinating research and development laboratories, from chief chemist, Durite Plastics unit of the Chemicals Division, the Borden Co.

Evans Research and Development Corp.—Dr. Murray Berdick to coordinator of research.

Engineering Corp. of America—C. H. Nichols to head of chemical engineering process design division.

Consolidated Engineering Corp.—James R. Bradburn to vice-president in charge of the computer division; Joseph H. Lancor, Jr., to vice-president in charge of engineering; Walter B. Claus to director of the transducer division.

Babcock & Wilcox Co.—George G. Zipf to superintendent of the tubular products division steel plant from assistant superintendent in charge of melting and blooming.

Rockwell Mfg. Co.—A. G. Ricketts from supervisor of the sales order department, Nordstrom Valve Division, to the Oakland, Calif., plant as coordinator of sales planning between the Pittsburgh, Pa., and Oakland plants. Joseph Pommersheim from project engineer at the Homewood plant to chief engineer of the Norwalk, Ohio, plant, Meter and Valve Division.

Stone & Webster Engineering Corp.—N. M. Floyd to manager of the San Francisco office, replacing Charles A. Bigelow, vice-president and director, who has retired after 45 years with the company; W. L. Sheets to manager of the Los Angeles office and general superintendent of the western area.

Vulcan Copper & Supply Co.—Raphael Katzen from manager of Vulcan engineering division to consultant with the firm. Dr. Katzen has opened his own practice as a consulting chemical engineer. His residence is at 3735 Dogwood Lane, Cincinnati 13, Ohio.

A. O. Smith Corp.—Charles E. Heitman from manager of the Automotive Division to the newly created post of assistant to the general manager of the company; Walter W. Stake from assistant general sales manager

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FALSTROM standard panel design is the result of years of experience in producing equipment for leading instrument makers and electronics manufacturers. FALSTROM standardization includes a series of instrument mounting structures that solve a wide variety of mounting problems. Sizes, dimensions, construction methods and styles are designed to save you time and money. Recommendations will be submitted promptly on receipt of drawings or specifications.

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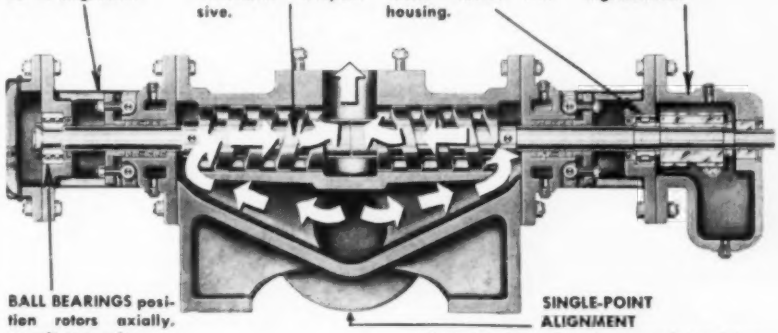
CENTER-LINE SUPPORTED gear housing. Doweled.



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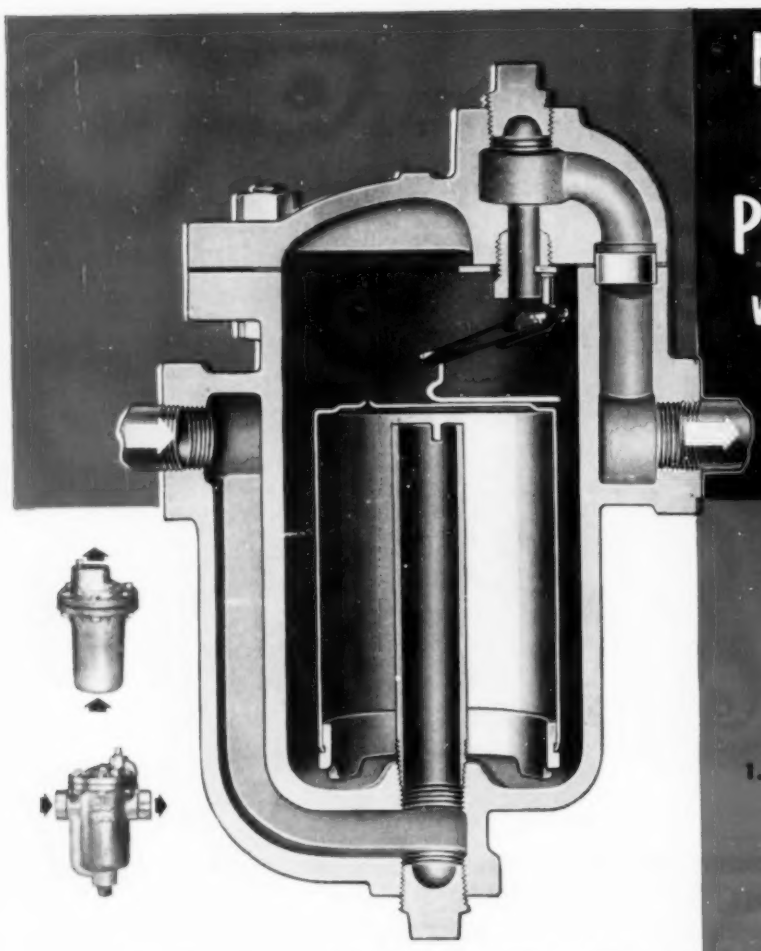

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2. Secondary lower leverage which permits the valve to travel well clear of the seat to minimize restriction to flow of condensate.

A single-phase lever can open just as large a valve *or* give just as great valve travel, *but not both.* Thus, Armstrong two-phase leverage gives very much greater capacity, depending on trap size than the earlier leverage system.

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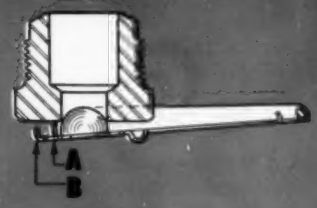
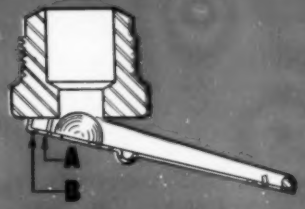
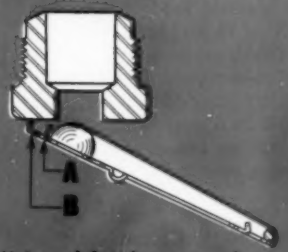


1. Valve in closed position.



2. As the bucket starts to sink, the lever fulcrums at "A", giving high leverage to open the valve against pressure. When valve is well open, the secondary fulcrum "B" touches the face of the valve seat.



3. Additional bucket travel results in fulcrum "B" becoming the pivot, permitting the valve to be opened wider so that restriction to flow of condensate is minimized.

ARMSTRONG STEAM TRAPS

of the Permaglas-Heating Division to regional manager of the eastern district, New York City; and Allen O. Dragge from sales representative, New York office, to regional manager of the Pacific Coast district, with offices in Los Angeles.

General American Transportation Corp.—Joseph C. Thompson to manager of eastern sales and Thomas A. Hartley to manager of New York sales of the plate and welding division. Both sales areas have offices at 380 Madison Ave., New York City.

National Lead Co.—Leonard Shapiro to post of senior chemist of the titanium alloy manufacturing division.

Lindberg Steel Treating Co.—Carl Meinhard from the Rheinische Rochrenwerke A. G., Dusseldorf, Germany, to the research staff; Muhammad Abdur Rashid to the metallurgical staff at the Melrose Park, Ill., plant.

Reliance Electric & Engineering Co.—C. V. Gregory from Pittsburgh district manager to newly created position of manager of district sales; Elwood H. Koontz from branch manager of Newark, N. J., office to Pittsburgh district manager; and F. Raymond Obenchain from sales engineer to Newark branch manager.

Union Carbide & Carbon Corp.—John M. Cole from the Bakelite Co. division to the fine chemicals sales group of Carbide & Carbon Chemicals Co., another Union Carbide division. He will assist in the market development of chemical intermediates, with particular emphasis on chemicals for use by the petroleum industry.

Le Roi Co.—Robert L. McChain to manager of coal mining machinery sales of the Cleveland Rock Drill Division.

St. Paul Hydraulic Hoist—John E. (Joe) Brown to district manager of the north central territory.

Mueller Co.—Allen D. MacLean to chief products engineer from a post with the Chaplin-Fulton Mfg. Co.

Monsanto Chemical Co.—Reid G. Fordyce to the new post of director of development and technical service, plastics division; Eli Haddad and Ivan V. Wilson to assistant directors of the technical service. Franklin J. Cornwell to general manager of sales of the merchandising division. J. Russell Wilson to vice-president and general manager

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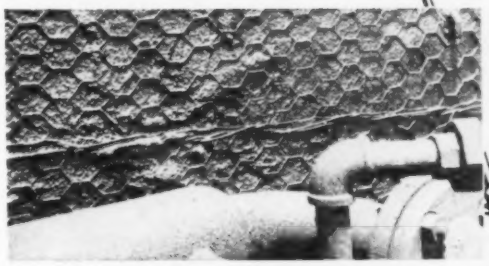
sprays on! —in one-third the time required for troweling



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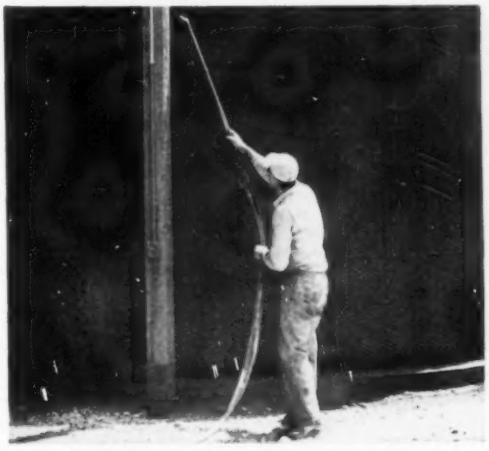
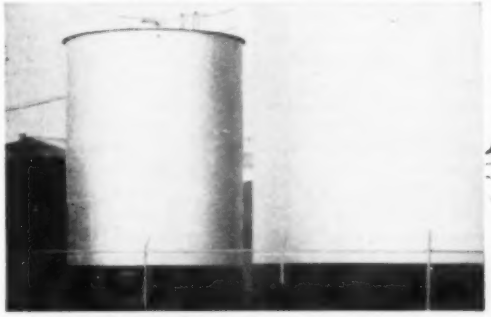


• SPRAY GUN applies second coat, too, in fastest possible time.



• TRIPLE-SEALED and smooth, after wet brooming.

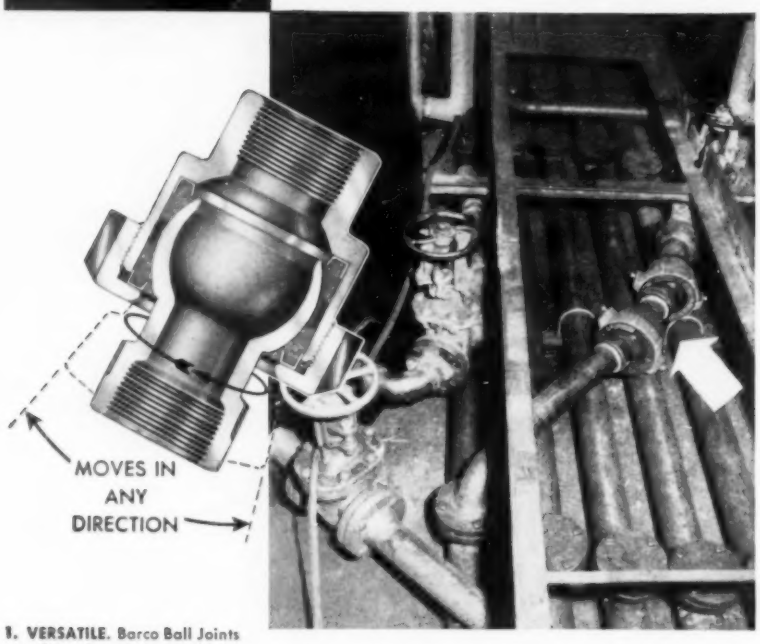
WEATHERCOAT—the standard of quality in the industry —for lasting protection.

AMERICAN Bitumuls & Asphalt COMPANY

200 BUSH STREET
SAN FRANCISCO 4, CALIF.

 (To obtain more data on advertised products see page 276)

BARCO *Flexible* BALL JOINTS



1. **VERSATILE.** Barco Ball Joints solve many piping problems where flexible connections are needed to allow for movement, overcome misalignment, and guard piping against vibration, strain or shock.
2. **MAXIMUM FLEXIBILITY.** Up to 40° side flexibility with 360° rotating movement.
3. **MANY STYLES AVAILABLE.** Angle or straight; threaded or flanged connections. For pressures to 7,500 psi; temperatures to 1000°F. 15 different sizes, ¼" to 12".
4. **CHOICE OF MATERIALS.** Built to meet service requirements for steam, oil, gasoline, water, chemicals, and other fluids.
5. **ENGINEERING RECOMMENDATIONS.** Barco will be glad to send you complete information—ASK FOR BULLETIN No. 215.

For LUBE OIL TRANSFER LINES

■ The above photograph shows a series of manifolds which carry various types of lube oil. Note the diagonal line (arrow) fitted with two BARCO BALL JOINTS. The diagonal line is connected to a storage tank, and the blank flange on each manifold is so positioned that the line with the joints from the storage tank can be connected to any of the manifolds. This type of hook-up is used for a number of installations. At the location pictured here, the company has about 20 storage tanks in the group. The Barco Ball Joints are 3" Standard Series, Style 7-8.

As compared with conventional fixed piping, this type of hook-up eliminates a considerable number of valves, fittings, and pipe, and requires little space. Also, it is practically foolproof by giving visual indication of the manifold being used.

For complete information about Barco Ball Joints and how to use them, write to BARCO MFG. CO., 559C Hough St., Barrington, Illinois.

BARCO

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING AND REVOLVING JOINTS

Suppliers

of the newly formed research and engineering division. Edward Schuler to western regional sales manager of the organic chemicals division.

Babcock & Wilcox Co.—E. T. Wilson, Jr., has been made sales representative of the Tubular Products Division in the Oregon, Washington, British Columbia, Alberta and Saskatchewan area.

General Aniline & Film Corp.—Dr. Frederick M. Meigs to assistant general manager of foreign operations. J. H. Hilldring, recently elected senior vice-president, will continue for the present as general manager of foreign operations.

General Electric Co., Trumbull Components Dept.—A. P. McGraw to manager of component sales, H. S. Hill to manager of internal sales, J. D. Hopkins to manager of product planning and marketing research, J. A. Kelly to manager, commercial service.

Branches, Distributors

Brown Fintube Co., has licensed Friedrich Uhde GMBH, 21b Dortmund, West Germany, to manufacture and sell Brown Co.'s products in West Germany and other countries in Europe, Africa and the Middle East.

Hewson Co., Inc., has made the Harris-Hanson Co., 5506 S. Kingshighway, St. Louis 9, Mo., its representative for sales, field application and servicing of its line of TAKK high voltage D.C. insulation test sets and high voltage power supplies, TAKK high speed static control systems and "Staticator" master static alarm systems in the territory of southern Illinois, Missouri and eastern Kansas.

Perkin-Elmer Corp., has opened sales and service offices in Chicago at 230 N. Michigan Ave., with John H. Rhodes in charge. The offices serve 10 midwestern states.

Expansion, Transition

Bailey Meter Co.'s Boston district office has moved to new quarters, 230 Congress St., Boston 10, Mass. The Boston territory serves Rhode Island, Massachusetts, Vermont, Maine, New Hampshire and Connecticut.

CEC Instruments, Inc., subsidiary of Consolidated Engineering Corp., has opened new and enlarged quarters at 1025 E. Green St., Pasadena, Calif., for its western regional office.

just published

PRICE MAKING and PRICE BEHAVIOR in the PETROLEUM INDUSTRY

by Ralph Cassady, Jr.

A complete analysis of competition, showing how prices are set on crude, refinery, tank wagon, and retail levels; how individual companies operate in getting business from one another; how price wars are waged, and what legal problems are involved.

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HYDRAULIC JET CLEANER

LEAST EXPENSIVE TO BUY & OPERATE — **MOST EFFECTIVE FOR HEAVY DUTY CLEAN-UP**

Operated by ordinary plant steam and cold water lines, this unit propels a solid jet of extremely high pressured hot water and detergent. The discharge force completely cleans areas up to 30 ft. from operation point, reaching inaccessible machinery parts. Eliminates down time and scaffolding. Removes all soil, sludge, and encrusted deposits.

CUTS CLEANING COSTS UP TO 94%

FOR ANY PLANT WITH 5 PSI STEAM & UPWARD

Write for literature and the name of our local distributor

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SELLERS Injector CORPORATION
1600 Hamilton Street Philadelphia 30, Pa.

Have you this LATEST DATA

on the revolutionary

Arnold O. Beckman INC.

OXYGEN ANALYZERS?

Throughout industry — wherever oxygen content of gases influences or controls petroleum or petro-chemical processes — Arnold O. Beckman Oxygen Analyzers are establishing completely new standards of accuracy, simplicity and convenience. These are the *only* instruments that make a direct physical measurement on oxygen itself — not of some variable secondary relationship.

Have *you* fully investigated the vital savings to be made by this revolutionary measuring principle in *your* operations? Are you aware of the latest money-saving applications for this equipment? If not, send for the following helpful literature. It's free!

BULLETIN 103: *Describes the Model G-2 Beckman Oxygen Analyzer — the instrument to use where maximum accuracy is essential. Model G-2 ranges are available for oxygen concentrations as low as 0-1000 parts per million — as high as 95-100% — or virtually any other range or combination of ranges. Bulletin 103 describes the unique magnetic operating principle used in Model G-2 Analyzers, equipment, accessories and typical applications.*

BULLETIN 108: *Describes the Model F-3 Beckman Oxygen Analyzer — the instrument designed primarily for industrial applications such as combustion control, catalyst regeneration, sulfur grinding, etc., which require an oxygen measuring range of 0-5%, 0-10%, 0-15% or higher. Bulletin 108 describes the unique magnetic operating principle used in Model F-3 Analyzers, gives equipment specifications and typical applications for this instrument.*

BULLETIN AD607: *Contains helpful charts and data on most efficient methods of controlling various combustion processes.*

BULLETIN AD608: *Outlines savings to be made with oxygen control in Cat Cracking operations, gives sampling suggestions and list of equipment.*

BULLETIN AD612: *Describes gas monitoring system for gas plants and compressor stations, shows sampling arrangement, lists equipment required.*

BULLETIN AD701: *Describes a sampling system particularly suited for Cat Cracker applications . . . includes illustration of equipment layout.*

The above informative literature will gladly be sent you free. For maximum convenience, use the coupon at right.

Arnold O. Beckman INC.

1020 Mission Street, South Pasadena 6, California

Please send Bulletins checked below:

☐ 103 ☐ 108 ☐ 607 ☐ 608 ☐ 612 ☐ 701

Name _____

Company and Address _____

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Position _____

THESE TWO EXAMPLES SHOW YOU

What Nordstrom Means by "Lubricaut

Nordstrom three-way Transflo valves on relief service at top of propylene tower separating propylene from propane.

TYPICAL NORDSTROM REFINERY APPLICATIONS

- Catalytic Polymerization
- Crude Topping and Vacuum Distillation
- Fluid Catalytic Cracking and Gas Recovery
- Distillate Recovery in Cycling Plants
- Duo-Sol Solvent Extraction
- Houdriflow Catalytic Cracking and Gas Recovery
- Light Ends Fractionating
- Thermal Cracking
- Phenol Extraction
- Propane Deasphalting
- Cycloversion
- Delayed Coking
- Girbotol Process
- Propane Dewaxing
- Hydroforming Process
- Naphtha Polyforming
- Solexol Process
- Solvent Dewaxing
- Thermal Reforming

Nordstrom has compiled a series of specification sheets for each of these processes, showing recommended materials, pressure classes, lubricants and valve figure numbers. Ask your Nordstrom sales engineer to review them with you.

TYPICAL NORDSTROM PROCESS INDUSTRY APPLICATIONS

- Beverage Plants
- Cement Plants
- Chemical Plants
- Explosives
- Food Plants
- Gas Plants
- Ice and Refrigeration
- Paint and Lacquer
- Paper and Pulp
- Pharmaceuticals
- Power and Steam Plants
- Rubber Plants
- Sewage Plants
- Smelters and Mines
- Soap Factories
- Steel Mills
- Sugar Refineries
- Synthetic Ammonia
- Synthetic Fibers
- Synthetic Plastics
- Synthetic Rubber
- Tanneries
- Textiles and Dyes
- Water Works

The new Nordstrom Corrosion-Resistant Valve Bulletin V-217 will make it easy for you to fit the right valve to each service. Write for a copy, Rockwell Manufacturing Company, Pittsburgh 8, Pa., or ask your Nordstrom sales engineer.

-Sealed for POSITIVE SHUT-OFF"

Here are two typical Nordstrom valve process applications—one is a propylene tower, the other a dry hydrogen line.

They illustrate an important point in specifying valves for process service . . . if really tight shut-off of hard-to-hold gases or fluids is important, no valve can do the job better than Nordstrom.

Why? Because Nordstrom is the original lubricated plug valve. Nordstrom is the valve with the extra seal of plastic lubricant around the valve ports to check seepage of even the lightest, most penetrating substances.

That, of course, means greater safety, and greater economy, too, because when leakage is prevented, valve life is far longer. And most important, it means uninterrupted operation of continuous process units—no down-time for avoidable valve repairs.

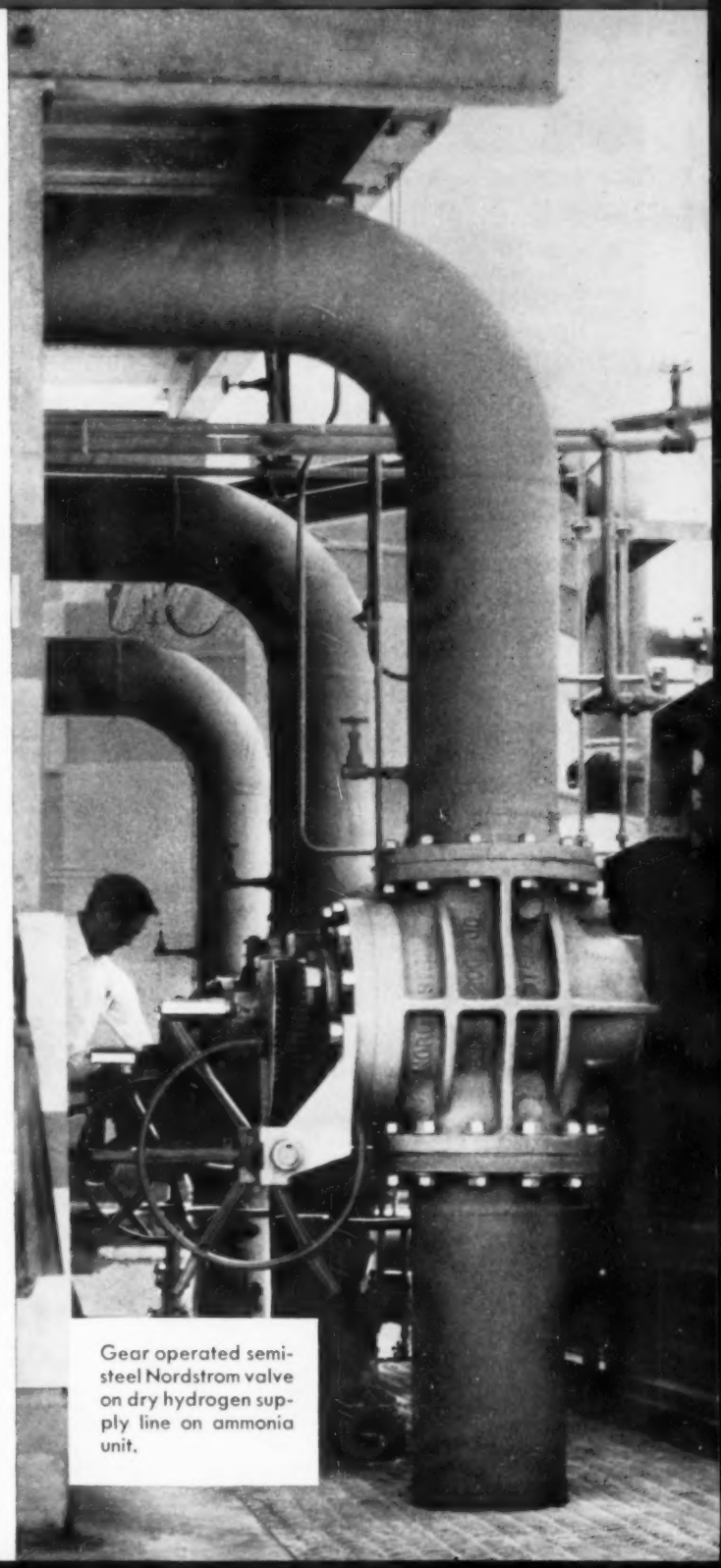
The same lubricant that seals, also keeps the valve ready to operate in an emergency.

Nordstrom valves are built in a wide range of sizes, pressures, special metals and body designs for the process industries, including three- and four-way designs for batching, blending and switching. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Licensee: Peacock Brothers Limited.

ROCKWELL Built
Nordstrom Valves
Lubricant-Sealed for Positive Shut-Off

Another ROCKWELL Product



Gear operated semi-steel Nordstrom valve on dry hydrogen supply line on ammonia unit.

SERIES LB CONOMOTOR CONTROL VALVES

Great strides have been made in recent years in the fields of instrumentation and automatic control. Most consideration has been given to primary elements, signal transmission and control instruments. But, not much has been done to radically change the *final control element.*

In the past decade Conoflow has made many contributions to the field of Final Control Elements by the development of pneumatic operators for throttling control service. Today, the Conoflow LB Control Valve represents one of the greatest forward steps in control valve design. We believe it heralds a new era of original thinking in keeping with the modern standards of the completely automatic plant.

The LB Conomotor Control Valve features a new type of pneumatic operator with ability to *sense* and *position*, and with *power* to operate under sudden load changes. It is mechanically sound with reliable *accuracy* and *stability.* It combines a new design of the already approved Conomotor Cylinder operator with a single seated, split body, integral bonnet valve, with an honest-to-goodness renewable seat ring and a fully guided plug and stem assembly. Result . . . the optimum in control and dependability.

Tho designed for the processing and power industries, Cylinder Conomotor Valves are finding application in hundreds of services that demand accurate and trouble-free control of a wide variety of fluid flows. Chances are, this is the all-important final link you have long sought for your control loop. It's worth talking over . . . Just write or phone today.

Write for Catalog LB-1, heralding this new "Step Ahead in Cybernetics."

CC-901

Cents-Controls

CONOFLOW CORPORATION

Foremost Manufacturers of Final Control Elements

2100 ARCH STREET, PHILADELPHIA 3, PENNSYLVANIA

Welding Society to Sponsor Exposition and Technical Meet

THE second welding and allied industry exposition will be given by the American Welding Society May 5 to 7 at the Memorial Auditorium, Buffalo, N. Y. Every type of welding equipment and most accessories will be on display. Exhibits will include equipment for manufacturing and structural purposes, as well as for maintenance needs. Considerable emphasis will be placed on welding techniques for the newer metals.

The society's national spring technical meeting will be held at the Hotel Statler in the same city from May 4 to 7. Papers read at the meeting will cover every phase of welding—welding engineering, welding procedure, welding metallurgy and weldable metals.

In addition to the exhibits and the technical sessions, visitors also will be taken on tours of major industrial plants in the area. This will give visitors a chance to hear a theoretical treatment at the technical sessions, see the machines which do the work, and inspect actual installations in factories.

The society's first show, held in Houston, Tex., last year, attracted persons from a large number of industries. The Buffalo exhibit will be almost twice as large, and the attendance is expected to be more than three times as great. More than 100 exhibitors are expected, and the products of over 300 companies will be shown.

The announcement of the exposition stresses that Buffalo had been chosen as the site because 90% of the major industrial centers of the U. S. and Canada are within a 500-mile radius of the city and many are much closer.

Compare Product Uses at Basic Materials' Conference

THE major properties and characteristics of basic materials will be compared at the second basic materials' conference, which will run concurrently with the basic materials' exposition from May 17 to 20 at Chicago's International Amphitheatre. This comparison is intended to help the manufacturer who is undecided about whether to use wood, plastic, steel, or some other substance, determine which will best suit his particular application.

Some means of making this information known is becoming more essential every day, the exposition producers say, because there are about 25,000 such materials currently in use from which a manufacturer must choose in designing his products. The problem is being further complicated by new types of high-speed manufacture which handle some materials better than others; consequently, product design is being affected by the demands of production departments.

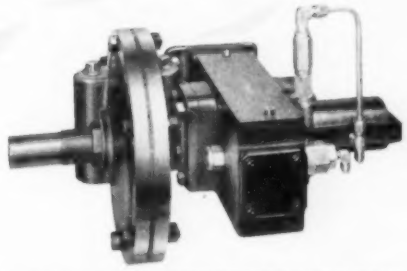
Only basic materials' producers may exhibit in the exposition, though manufacturers of end products and equipment producers may attend as visitors. Exhibit space has been increased by 50% over last year's show, the producers report.

Sponsors of the exposition, serving under Don G. Mitchell, chairman of the board, Sylvania Electric Products, Inc., N. Y., include the following: George Bachner, general manager,

A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet."

McGraw-Hill Publishing Company, Room 2710, 330 West 42nd St., New York 36, N.Y.

Measure & Transmit MICRO-PRESSURES



the ASKANIA PNEUMATIC TRANSLATOR

For the transmission of low static or differential pressures . . in the range of 0–1.0 w.c. or higher. For automatic control or recording of pressure, flow, or liquid level.

It measures low-level signals and transmits an air signal or output pressure at a higher level . . usually standard instrument range of 3–15 p.s.i.

Accurate to ±0.5%. Diaphragm measurement of static or differential pressures eliminates trouble associated with mercury manometers.

For additional details, ask for bulletin 154.

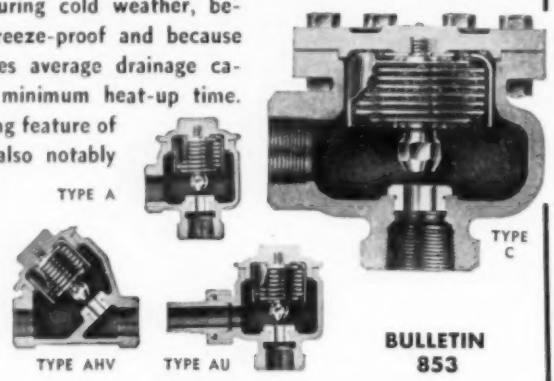
ASKANIA REGULATOR COMPANY
240 E. Ontario Street Chicago 10, Illinois
Subsidiary of General Precision Equipment Corp.

NICHOLSON MAKES

Freeze-Proof Steam Traps

for Every Plant Use

Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates heat transfer in severe weather. Types for every plant use. Size ¼" to 2"; pressures to 250 lbs.



BULLETIN 853

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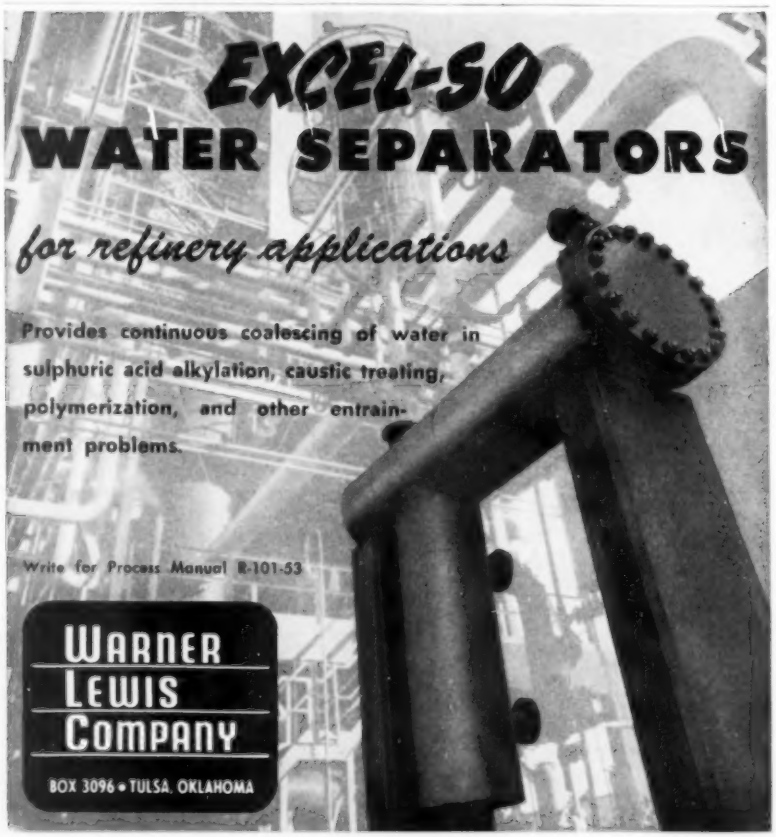
W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS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WATER SEPARATORS
for refinery applications
Provides continuous coalescing of water in sulphuric acid alkylation, caustic treating, polymerization, and other entrainment problems.
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Meetings

Powdered Metal Products Division, Yale & Towne Mfg. Co., Franklin Park, Ill.; Carl I. Collins, president, Superior Steel Corp., Carnegie, Pa.; M. J. Donachie, president, Beryllium Corp., Reading, Pa.; R. S. Reynolds, Jr., president, Reynolds Metals Co., Louisville, Ky.; and W. J. Stebler, executive vice-president, General American Transportation Corp., Chicago.

Oil Man's Calendar

FEBRUARY

Instrument Society of America, annual regional conference, Statler Hotel, New York City, Feb. 4.

Western Petroleum Refiners Ass'n, regional meeting, Hotel Beaumont, Beaumont, Texas, Feb. 11-12.

Natural Gasoline Ass'n of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Texas, Feb. 26.

MARCH

American Society for Testing Materials, spring meeting, Hotel Shoreham, Washington, D. C., March 1-5.

Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, William Penn Hotel, Pittsburgh, Pa., March 1-5.

National Ass'n of Corrosion Engineers, 10th annual conference and exhibition, Kansas City Municipal Auditorium, Kansas City, Mo., March 15-19.

Western Petroleum Refiners Ass'n, annual meeting, Plaza Hotel, San Antonio, Texas, March 29-31.

APRIL

American Society of Lubrication Engineers, Netherland-Plaza, Cincinnati, Ohio, April 5-7.

National Petroleum Ass'n, 51st semi-annual meeting, Cleveland Hotel, Cleveland, Ohio, April 14-16.

Natural Gasoline Ass'n of America, 33rd annual convention, Baker Hotel, Dallas, Texas, April 21-23.

Ass'n of Consulting Chemists and Chemical Engineers, symposium and banquet, Hotel Belmont Plaza, New York, April 27.

MAY

Liquefied Petroleum Gas Ass'n, annual convention, Conrad Hilton Hotel, Chicago, Ill., May 9-12.

American Petroleum Institute, Division of Refining, 19th mid-year meeting, Rice Hotel, Houston, Texas, May 10-13.

2nd Basic Materials Exposition and Conference, International Amphitheatre, Chicago, Ill., May 17-20.

JUNE

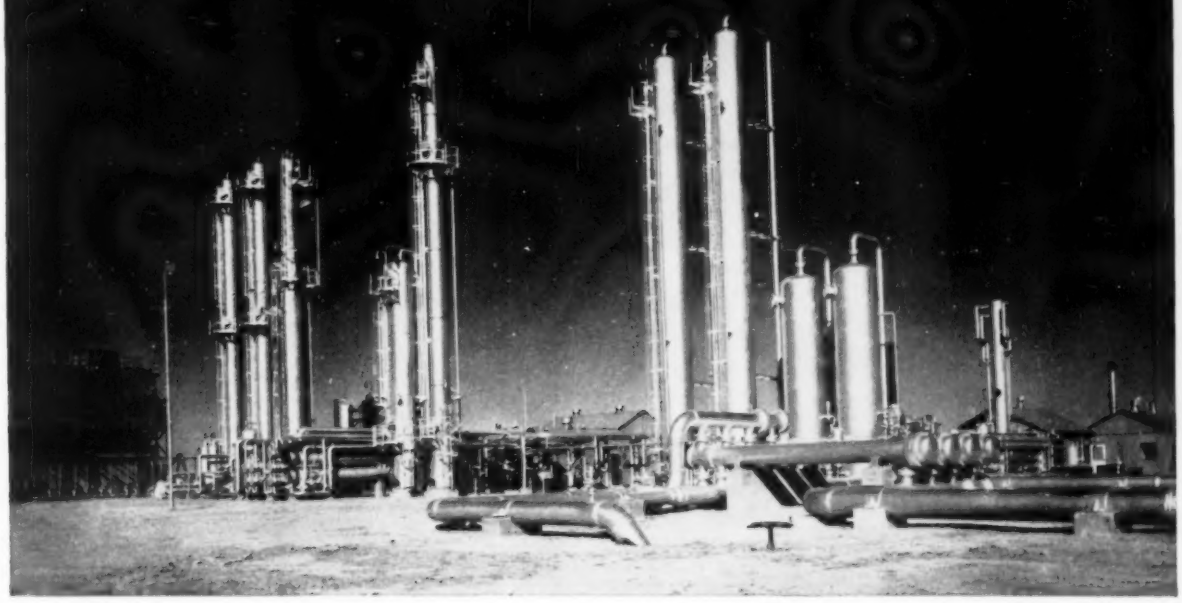
American Society for Testing Materials, 57th annual meeting and exhibit of testing apparatus, Sherman and Morrison Hotels, Chicago, Ill., June 13-18.

American Institute of Chemical Engineers, meeting on nuclear energy, University of Michigan, Ann Arbor, Mich., June 20-23.

JULY

1st Western Plant Maintenance Show, Pan Pacific Auditorium, Los Angeles, Calif., July 13-15.

EXPERIENCE MAKES THE BEST PUPIL



The modern gas industry requires a lot of old-fashioned know-how. It takes a company like Pritchard—with more than a quarter of a century's experience—to understand the complexities of modern technology . . . to keep pace with the many new design, engineering and construction developments in the gas processing field. All that Pritchard has learned, all the exceptional skills and techniques acquired during those long years of proved ability, make possible for you new accomplishments today and tomorrow.

Without that vital background, Pritchard would not be so uniquely qualified to provide modern, efficient processing facilities like the natural gasoline recovery plant shown here which was designed and built by Pritchard for the Hugoton Production Company of Ulysses, Kansas. This plant handles a daily capacity of 90,000,000 SCF.

Why don't you depend on Pritchard for complete "drawing board to on stream" service? Your inquiry will receive complete and immediate attention.

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Oil Burners

OF THE STEAM AND MECHANICAL TYPES NOW COMBINED INTO

Dual Stage BURNERS

Now, at last, the inherent advantages of *both* systems of fuel oil atomization are *profitably* yours . . . within the one, new NATIONAL AIROIL Dual Stage Burner.

41 years of combustion equipment design and manufacture are in back of the Dual Stage Oil Burner . . . and, it has been thoroughly tested and proved in the field for firing: Petroleum Processing Heaters; Rotary Kilns; H.R.T., Scotch Marine and Water Tube Boilers; etc.

Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel oil from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft or, the NATIONAL AIROIL Tandem Unit for natural or induced draft furnaces.

Get detailed information, illustration, and specifications in NATIONAL AIROIL Bulletin 25.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNER
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
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Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

ADSORBTIVE CLAY, "Florex"; sample and full details; Floridin Co. See adv't p. 287.

AGITATORS, liquid; booklet No. 58W; Struthers Wells Corp. See adv't p. 157.

AIR PREHEATERS, Ljungstrom; Catalog L-3; the Air Preheater Corp. See adv't p. 177.

ALLOYS, corrosion-resistant; samples; Haynes Stellite Co. See adv't p. 251.

ALLOYS, for condenser and heat exchanger tubes and plates; Publication B-2; the American Brass Co. See adv't p. 172.

BALL JOINTS, flexible, for lube oil transfer lines; full information; Barco Mfg. Co. See adv't p. 266.

BASIC MATERIALS; booklet, "Basic Materials"; Norton Co. See adv't p. 175.

CASTINGS, steel; full information; Lebanon Steel Foundry. See adv't p. 289.

COMPRESSOR, ammonia; information; Worthington Corp., Air Conditioning and Refrigeration Division. See adv't p. 176.

CONNECTIONS, pipe, Chemiseal; full information; United States Gasket Co. See adv't p. 160.

DEHYDRATION with alumina; full details; Alcoa Chemicals. See adv't p. 171.

DIAPHRAGMS, molded; Bulletin CV53; Kieley & Mueller, Inc. See adv't p. 181.

DRUM FILLER, automatic; full information; Rucker Co. See adv't p. 164.

FANS, multi-blade, aluminum; Bulletin CF-54; Marley Co. See adv't p. 244.

GAGES, "Varec" automatic tank gages; Bulletin CP 3501; Vapor Recovery Systems Co. See adv't p. 283.

GAGES, welding pad; complete details; Jerguson Gage & Valve Co. See adv't p. 255.

GASHOLDER, waterproof; full information; General American Transportation Corp. See adv't p. 279.

HEATERS; booklet available; Selas Corp. of America. See adv't p. 195.

HEAT EXCHANGERS, sectional; Bulletin 512; Brown Fintube Co. See adv't, fourth cover.

PRESSURE TRANSMITTERS; Bulletin 154; Askania Regulators Co. See adv't p. 271.

PUMPS, controlled volume; Bulletin 1053; Milton Roy Mfg. Co. See adv't p. 179.

PUMPS, screw, bracket type; Bulletin SE-5; Sier-Bath Gear & Pump Co. See adv't p. 263.

PURIFIER; Bulletin No. 700; the V. D. Anderson Co. See adv't p. 291.

SULFONATES, petroleum; full information; L. Sonneborn Sons. See adv't p. 158.

TANK CLEANING with chemicals; Booklet F7629 about "Oakite"; Oakite Products, Inc. See adv't p. 285.

TURBINES, DH line; Turbine Catalog 500; Dean Hill Pump Co. See adv't p. 166.

VALVES, control; Bulletin, "Annin Valves"; Annin Co. See adv't p. 174.

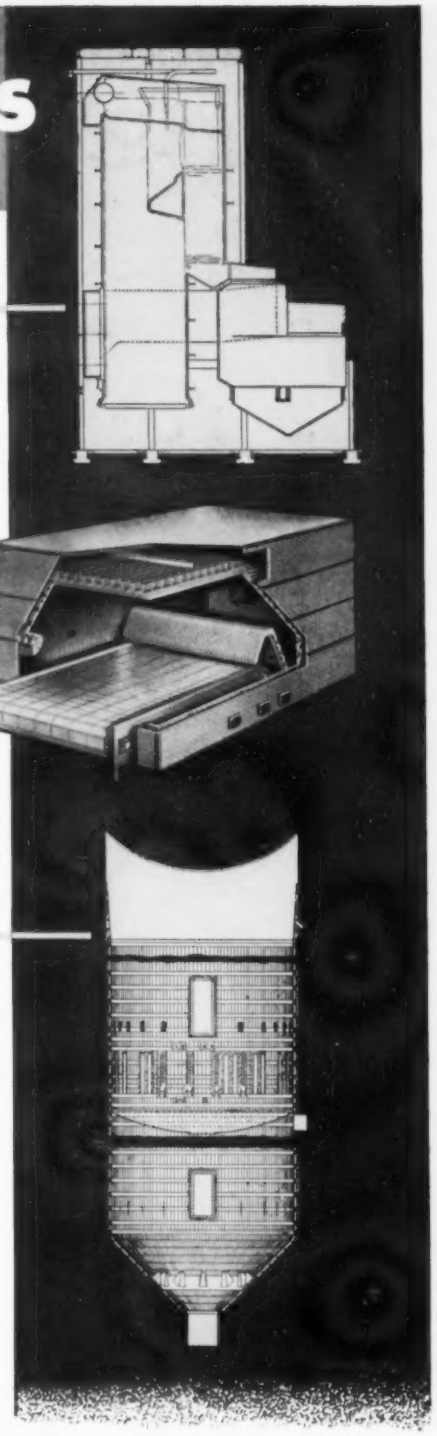
VALVES, corrosion-resistant; Valve Bulletin V-217; Rockwell Mfg. Co. See adv't p. 268-269.

VALVES, final control, series LB; Catalog LB-1, "Step Ahead in Cybernetics"; Conoflow Corp. See adv't p. 270.

VALVES; information; Crane Valves. See adv't p. 185.

VALVES, line blind, "L" and "T"; catalog; Hamer Oil Tool Co. See adv't p. 286.

RIGHT IN THE HEAT OF THINGS



in Power Plants

. . . you'll find economy-minded B-L boiler enclosures in power plants all over the country. Size poses no problem: B-L engineers them all from small HRT settings to huge 10-story jobs like the one illustrated.

in Chemical Plants

. . . Bigelow dryer furnaces deliver a tremendous volume of hot gases—as much as 93,000,000 BTU's—at predetermined temperatures to rotary dryers. Furnaces process coal, sugar, salts, grain—any product from which moisture must be removed.

in Oil Refineries

. . . B-L offers a complete, one-source service of engineering, materials, and erection help for castable regenerators and pressure vessels of all kinds. Construction can be either castable, tile or a combination of the two.

yes, and in the metal, glass, cement and sugar industries (others, too!) B-L enclosures are right *in the heat of things.* Write today for complete information.

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and Bigelow-Liptak Export Corporation

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In Canada: Bigelow-Liptak of Canada, Ltd., *Toronto, Ontario*

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FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

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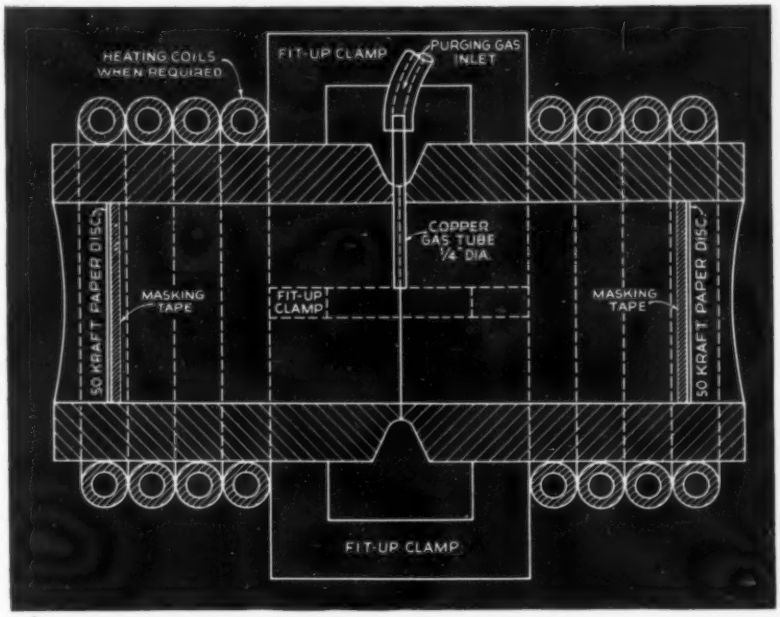
WHAT'S NEW . . .



Here's Faster Pipe Welding

Money, time, and materials are said to be saved by a new pipe welding process developed in the laboratories of Stone & Webster Engrg. Corp., involving gas shielded arc welding of pressure piping. Joints are welded faster because no metallic backing rings are required, possible wrinkles are eliminated, and any former obstructions are removed.

Field erection is a particularly suitable application for this technique, which uses the inert gas as a backing, thus eliminating the need for the usual special fixtures involved in other methods. The new method employs paper discs placed inside the piping and held in place with masking tape. The inert gas — usually argon — is inserted through a small hole in the welding groove.

Procedure is as follows (as described by R. T. Pursell of the company, under whose supervision the method was developed):

Prior to fitting the pipe ends together, a paper disc is placed in each pipe, approximately 6 in. from the end and secured with masking tape. The ends are then fitted together in the usual manner. A 3/16-in. diameter hole is drilled in the center of the welding groove and a copper tube, attached to the argon supply, is inserted through this hole.

With preheat temperature already attained, the backing gas supply is bled into the pipe. The first bead is made by fusing together the root edges of the joint using the process: no filler metal is used. Once this much of the weld is made, it is possible to inspect visually the inside condition by inserting an optical instrument through the hole used for passing in the backing gas. Any defects are repaired by re-melting those areas from the outside.

When the inside condition is acceptable, backing gas is again applied and the second bead is deposited. Visual inspection is again performed in order to insure an adequate root.

Backing gas is bled into the pipe to fill the reservoir between the paper discs, the copper inlet tube is then removed and the hole welded shut using a filler rod. Throughout the visual inspections, a preheat temperature of 150° F. is maintained in order to prevent harmful effects on the instrument.

By depositing a second bead with filler rod added, the root portion of the joint is more adequately prepared for the subsequent arc welding process used for completing the joint.

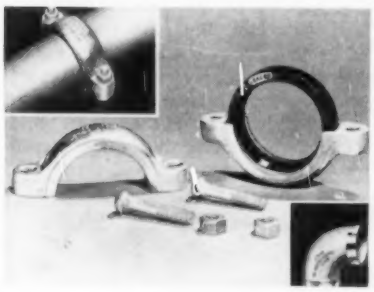
Paper discs and masking tape burn up during the stress relieving operation. Many tests performed on No. 50 Kraft brown wrapping paper showed that tape and paper burn completely at a base metal temperature between 550 and 600° F. Therefore, all preheat temperatures were at 400° F., with a minimum of 350° F. All of the stress relieving temperatures were 1350 ±25° F.

A patent application has been filed covering the apparatus and method. Stone & Webster Engrg. Corp., Boston, Mass.

Circle No. **1** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.



New Line of Grooved Fittings For Aluminum Pipe Available

. . . in sizes 2, 4, 6, and 8 in. "Gruvagrips" are suitable for use wherever extremely light, high pressure systems are needed. The 8-in. size weighs less than 11½ lbs. complete—about half as much as a similar malleable iron coupling. The couplings are said to absorb automatically expansion and contraction, shock, ground motion, and vibration. They will remain leakproof under end pulls up to 46,000 lbs.; permit layout misalignment up to 3°; withstand temperatures between 200° F. and —65° F. They can be removed and re-used repeatedly. Sealing gasket is of a resilient synthetic rubber designed to resist oils and chemicals. Fittings are machined to standard grooving dimensions and are completely reclaimable. They come in 90° and 45° ells, tees, caps, and nipples. Gustin-Bacon Mfg. Co., 210 West 10th St., Kansas City 6, Mo.

Circle No. **2** *on Reply Card*

'Couples' Made Fast-Connecting

Quick and easy assembly and disassembly is possible in the new "Conax Quick-Disconnect" Thermocouples by simply plugging the polarized jacks together and turning the nut finger tight. The units are said to be ideally suited for many laboratory and industrial applications. They are available as a complete unit or as component parts, providing the quick-disconnect couplings or complete thermocouple assemblies. The units are water-tight and vapor-proof. Neoprene seals the lead wires and the plug connections when turned down finger tight. Polarized plugs and sockets prevent crossing of thermocouple leads. Accuracy is maintained because the plugs and sockets are made of the same material as the thermocouple and will not break the continuity between element and lead wires. Fast response is obtained by use of a small diameter, low mass, stainless steel protection tube. Connector body is of black anodized aluminum for optimum corrosion resistance. A wide range of protection tube lengths and easy interchangeability provide good standardization. The closed end protection tube normally furnished has a rolled, homogenous welded and polished tip which is attached to the connector body by a standard 37° flare fitting, and it can be readily replaced in case of damage. Conax Corp., 4515 Main Street, Buffalo 21, N. Y.

Circle No. **3** *on Reply Card*

New Air-operated Gun Speeds Application of Refractory Lining

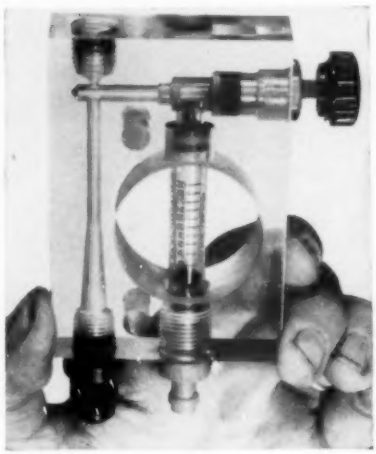
. . . and helps reduce the cost of many time-consuming hand applied jobs. The "Vibron Bantam" also enables the user to apply the refractories with 40 to 50% less moisture and thus produce longer-lasting linings or patches, according to the manufacturer. A high-frequency stroke—4800/minute—is achieved with a compressed air-operated mechanism designed to eliminate metal-to-metal contact in the piston and quiet operation. The unit weighs five lbs. and operates at between 85 and 130 psi. A small head is used for initial sewing or ramming, while a larger molding head applies the finish. The gun comes equipped with a 10-ft. flexible air hose and a quick-connect swivel coupling. Vibron Div., Burgess-Sterbentz Corp., 3790 West 150th St., Cleveland 11, Ohio.

Circle No. **4** *on Reply Card*

Plastic Rope Shows Promise As Natural Fiber Substitute

. . . in general yard service for refineries, petrochemical plants, and the like. It is made by converting films of such plastics as polyethylene and "Mylar" into rope by a special mechanical process recently developed. The film is first elongated and spun into thread, then twisted into strands, and finally closed into a multi-strand rope. Polyethylene has the advantage of a cost comparable to that of cotton fiber ropes plus high resistance to most chemicals, and complete and indefinite water buoyancy, according to the manufacturer. Mylar, while more expensive and not capable of floating, has tensile strengths upward of 25,000 psi. as compared to 1800 psi. for straight polyethylene ropes. Both materials have high corrosion resistance. The new ropes are produced in standard coil lengths and in all regular diameters, from ⅛ to 1 in., with larger diameters being produced to meet special requirements. U. S. Plastic Rope, Inc., 2581 Spring St., Redwood City 7, Calif.

Circle No. **5** *on Reply Card*



Liquid Feeder Eliminates the Need for Proportioning Pumps

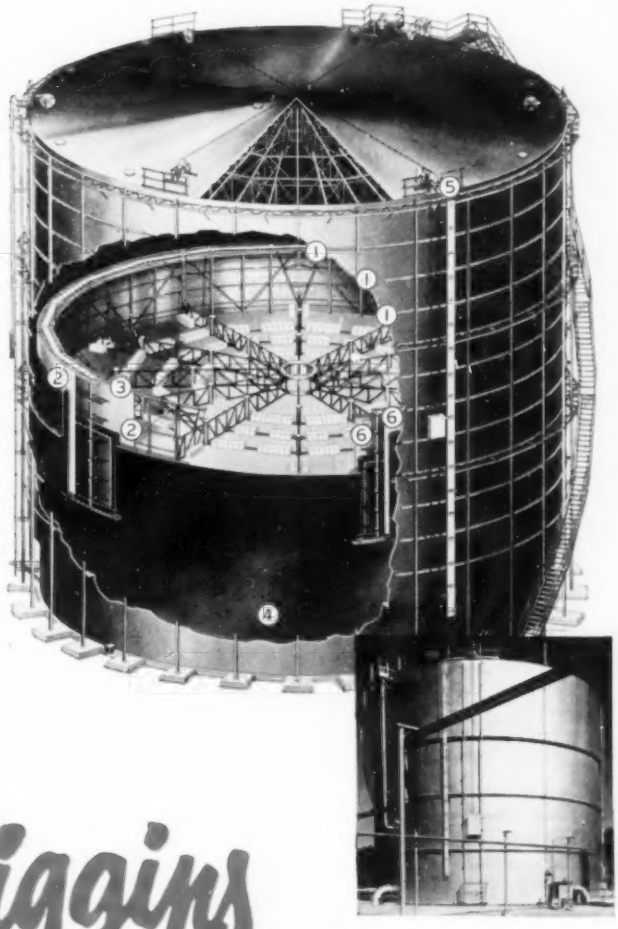
. . . because of a built-in ejector. The new "Feedrator" is designed for simultaneously metering, controlling, mixing, and dispensing small quantities of liquid chemicals into liquid streams. A pressure differential in the main line, to create a by-pass flow through the ejector, is all that is necessary to operate the unit. Many corrosive chemicals can be fed directly into the main process stream because the unit is enclosed in a Lucite block. For additives which Lucite cannot handle satisfactorily, the block is also available in Uscolite at some additional cost. Small size of the body block—4¼ x 2¾ in.—affords ease of mounting. The pipeline adaptor screws directly into the body block also. By-pass flow required is relatively small. Injection flow is controlled precisely with the needle valve. The unit comes in four standard models with capacities ranging from 0.03-0.3 to 2-20 gal./hr. A small ball check valve provides protection against sudden pressure drops. Fischer & Porter Co., 19 Jacksonville Rd., Hatboro, Penna.

Circle No. **6** *on Reply Card*

GUIDES TO GASHOLDER PLANNING

no. **4** *of a series*

As production men, what we want to know is . . .



1 Top section of shell completely ventilated

2 Wide clearances simplify operation

3 Gas-tight friction-less seal not affected by weather

4 Piston rests on bottom—less than ½ of 1% for purging

5 Leveling device—independent of side-wall—keeps piston level

6 Fenders prevent all tension in seal

How weatherproof can a gasholder be?"

Will rough weather mean operating headaches? Conventional gasholders must be checked frequently to guard against weather hazards. Icy days can mean the expense of a maintenance crew chopping away profits on your gasholder to free the frozen seal. This condition means costly interruption of service.

Only the Wiggins Gasholder has the patented Wiggins *dry* fabric seal. There's no water, tar or grease to service—nothing to freeze, evaporate, blow out or leak.

How weatherproof can a gasholder be? Performance of the Wiggins Gasholder has been proven in over 15 years of field operation—with installations from coast to coast, from the Gulf to Canada, and in Iceland and Brazil.

Write General American for the complete facts.

Wiggins Gasholder

WIGGINS VAPOR SEALS GENERAL AMERICAN TRADE MARK

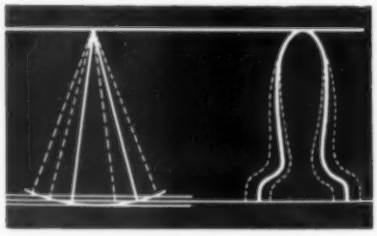
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street • Chicago 90, Illinois • **Offices in Principal Cities**

Fast Connection to Grooved Pipe Ends Possible in New Valve

. . . design of standard two-bolt yoke type, semi-steel, lubricated plug valves. A tight, permanent connection can be made in a matter of minutes and lines may be dismantled as often as necessary without damage to the pipe or end couplings. Valve is suitable in refineries, for stock lines, transfer lines, tank connections, circulating cooling systems, and fire protection. It is wrench-operated and has a pressure rating of 175 psi., WOG; and is available in 2, 2½, 3, and 4 in. sizes. The flexible character permits deflections of several degrees at every joint and also offsets pipe vibration as well as overcoming the problem of pipe expansion and contraction. Nordstrom Div., Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Penna.

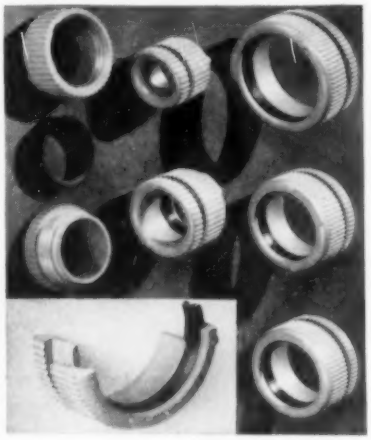
Circle No. **7** *on Reply Card*



Re-designed Metallic Bellows Finds Application as Shaft Seal

. . . expansion joint, or vibration absorber. Developed originally for atomic energy use, its construction is said to give long life under severe conditions of corrosion, vibration, and high temperature. Analysis of bellows failures indicated that they occurred mainly at the bend in each convolution, due to the concentration of flexing at that point during expansion and contraction of the bellows, causing work hardening of the metal. The new welded diaphragm construction, shown in the drawing, distributed flexing over the entire height of the convolution. In addition, flexibility can be increased by increasing the height of convolutions. This permits a bellows with high flexibility for lines conveying gases or liquids at low pressure. At the same time, this great flexibility can be attained with metal of sufficient thickness so that these bellows for low pressure lines can withstand the high external pressures such lines are often subjected to. Further; the increase in flexibility with height of convolution also permits greater expansion range for bellows length than is said to be possible with conventional bellows construction. Thus, relatively long expansion ranges can be achieved in bellows of comparatively short initial length. Two types of bellows are available: the standard male expansion, and the nesting styles. The former comes in 50 standard sizes from 1 to 36 in. I. D.: the nesting type in 27 sizes, from 0.687 to 7.375 in. I. D. Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

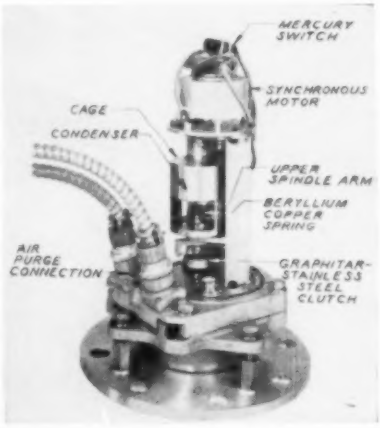
Circle No. **8** *on Reply Card*



New Plastic Clamp Designed for Plastic Pipe and Insert Fittings

. . . for effecting a tight, permanent seal, and permitting installation of a completely plastic piping system. It replaces a steel clamp which had been used previously for insert connections. The unit uses the same principle incorporated in the compression coupling recently developed by the manufacturer for rigid "Carlon" plastic pipe. It is molded in two separate, threaded sections. Butted against a shoulder at the base of the female threads in one half is a synthetic gasket with a V-shaped groove. When the other half of the clamp is screwed down onto this gasket it is forced against the pipe. Thus, full circle pressure is exerted on the pipe. The plastic material is impervious to rot, rust, and electrolytic corrosion. The clamp is produced in sizes for ½, 1, 1½, 2, 3, 4, and 6-in. plastic pipe. It can be tightened by means of a strap wrench and can be removed and re-used when installations are changed. Carlon Products Corp., 10225 Mech Ave., Cleveland 5, Ohio.

Circle No. **9** *on Reply Card*



Torque-type Viscometer Permits Continuous Process Control

. . . in a flow-line by-pass, or a processing vessel. It can be used for base mount temperatures up to 200° F. and in pressure conditions from 8 mm. Hg. vacuum to 100 psi. All moving parts of the "Viscometran" are mounted on rigid aluminum castings and enclosed by a 3/32-in. steel valve cap. The base, also cast for maximum strength, is hinged so the spindle can be removed quickly for inspection, range change, or cleaning. The instrument is mounted on a 4-in., 125-bl. standard American pipe flange. In use, the spindle is rotated by a synchronous motor at a constant speed in the liquid under test. The torque required to produce this rotation is directly proportional to the centipoise viscosity of the fluid. Using either a variable capacitance or a variable resistance, the Viscometran transmits a viscosity signal to a suitable receiver by sending an electrical impulse proportional to the torque. Viscosity is measured at a constant rate of shear because of the constant spindle speed. Brookfield Engrg. Labs., Inc., 240 Cushing St., Stoughton, Mass.

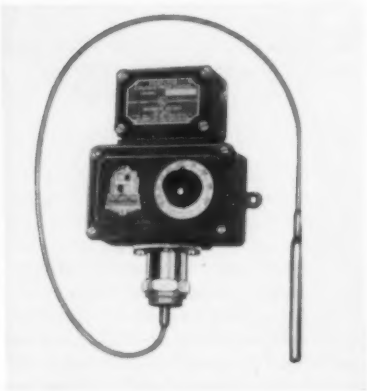
Circle No. **10** *on Reply Card*

What's New:

New Remote Control 'Deadman' Valve Is Aid in Sandblasting

. . . machines by providing instant control of blasting at the nozzle head. It reduces manpower and material costs by 20-40% and is said to insure complete safety for the workman. Blasting is started by depressing the hand valve. It is stopped when the operator releases the hand valve. Resulting pressure drop opens a bleed-off valve in less than two seconds, releasing all pressure in the system completely. Simultaneously, the air intake valve—through which the sand pot is charged—is closed in order that no pressure may enter. The "Recova" control cuts labor by eliminating the need for a pot tender on small jobs, and reduces loss of material by its instant shut-off. A new unit can be installed in 15 minutes with no electrical connections. Clementina Ltd., 2277 Jerrold Ave., San Francisco, Calif.

Circle No. **11** *on Reply Card*

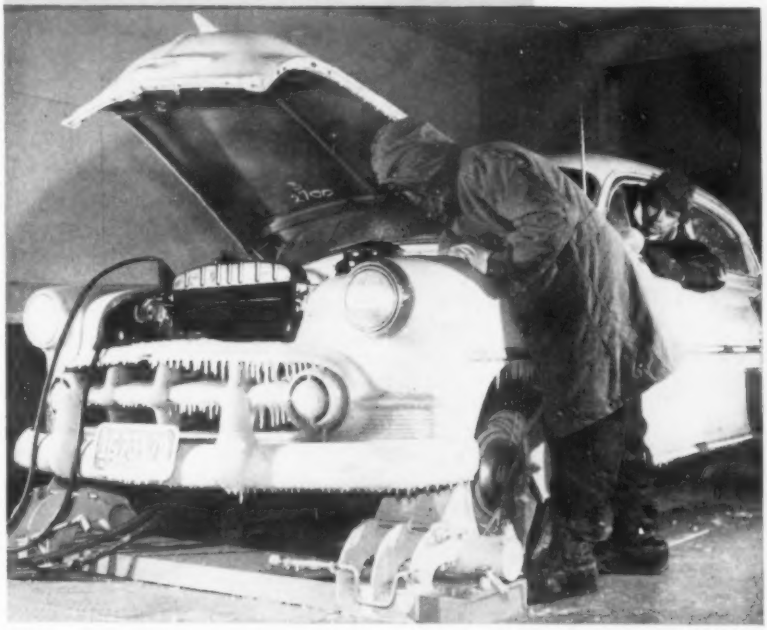


Explosion-Proof Temperature Control Covers Many Hazards

. . . including Class I, Group C and D; atmospheres containing ethyl ether vapor; gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors, and natural gas. It is also approved by the Underwriters' Laboratories, Inc., for Class II, Groups E, F, and G. The Model "VS" Control is designed to maintain temperature by controlling flow of steam, oil, gas, or electricity. It may also be used to regulate flow of a coolant. The instrument is said to be especially suitable for use where constant visual evidence of temperature is not required. It can be supplied with a calibrated temperature scale. Dials on the uncalibrated models are marked with divisions from 0 to 50 which can be logged for duplication in setting. Model VS is available with any of 10 elements covering

ORONITE
LUBE OIL
ADDITIVES

Low temperature performance evaluation seen from inside new all-weather chassis Dynamometer test cell.



will help you stay ahead of competition

This new chassis Dynamometer is typical of the advanced research we employ to develop superior Oronite additives. The research and testing facilities behind Oronite additives are the most advanced in the nation.

With years-ahead research, it is possible that Oronite additives could provide your finished oil with the competitive advantages you need to win and hold a market. Oronite will tailor-make additives to your base oils — meeting your price and performance specifications.

Why not see what Oronite additives can offer you? Phone or write the Oronite office nearest you. An additive specialist will contact you on request.

With Oronite Additives you can formulate oils to meet the new A.P.I. Service Classifications and can meet specifications for 2-104-B, MIL-O-2104, Supplement I and Series 2 oils.

OTHER ORONITE PRODUCTS

Gas Odorants
Polybutenes
Phenol
Dispersant FO
(Furnace Oil Inhibitor)
Wetting Agents

ORONITE CHEMICAL COMPANY
38 Sansome Street, San Francisco 4, California
30 Rockefeller Plaza, New York 20, New York
600 South Michigan Avenue, Chicago 5, Illinois
Standard Oil Building, Los Angeles 15, California
Mercantile Securities Building, Dallas 1, Texas

ORONITE CHEMICAL COMPANY

The Control of Corrosion In Crude Units With Unicor

Corrosion of steel or Admiralty tubes in crude unit exchangers and condensers is a common problem. Corrosion is usually caused by hydrogen sulfide and hydrochloric acid. Hydrogen sulfide may occur in sour crudes, but is also formed by the decomposition of unstable sulfur compounds. Hydrochloric acid is formed by the hydrolysis and partial dissociation of magnesium and calcium chloride. Magnesium chloride hydrolyzes most completely; calcium chloride less completely, and sodium chloride not at all.

Even at the low salt content of three pounds per 1,000 barrels, receiver water may be very acid, registering a pH as low as 2-3. Ammonia is commonly injected above the top tray to neutralize excessive acidity. It is desirable to limit the use of ammonia to trim costs and reduce the deposit of ammonium salts on plates and tubes. For good corrosion control, it is necessary to maintain pH between 6.5 and 7.5. In plant operation it is often difficult to control pH closer than about 3 units. This wide variation causes steel corrosion under acid conditions and Admiralty attack under alkaline.

The injection of Unicor as a primary preventive supplemented by the limited use of ammonia is a new and highly effective means of corrosion control.

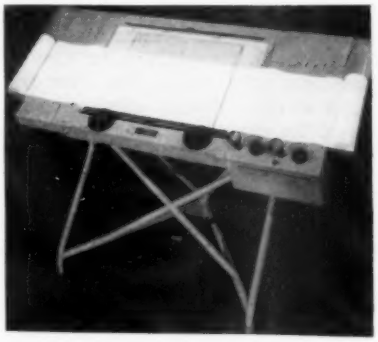
Unicor is a surface-active, oil-soluble corrosion inhibitor which causes oil to wet metals preferentially, thus creating a film that protects the metal from the corrosive water phase. It widens and lowers the safe pH control range, lowers ammonia requirements and as a result reduces salt formation. Salts are washed from the system by detergent action, thus minimizing tube deposits. This increases heat exchange efficiency, resulting in savings which far exceed the normal inhibitor cost of 0.1 to 0.2 cents per barrel.

Extensive field tests and commercial use have proved that the **Unicor Corrosion Control Sytem** is an excellent way to protect crude units and other refinery equipment subject to internal corrosion.

What's New!

ranges from —30 to 1200° F. Mercury actuated, the switch's maximum rating by Underwriters' Laboratories is 4 amps. at 125 volts, 2 at 250, noninductive A.C., for normal service. For pilot duty, it is rated at 50 volt-amps inductive load. The control measures 6½ in. high, 6½ in. wide, and 3¼ in. deep, and it weighs 4½ lbs. Partlow Corp., New Hartford, N. Y.

Circle No. **12** *on Reply Card*



New Device Measures Film and Oscillograph Records Faster

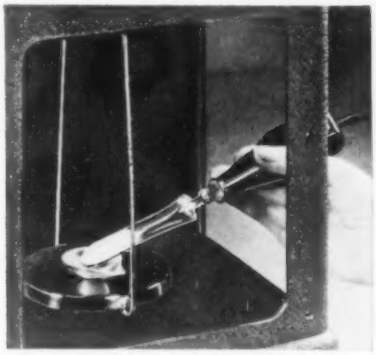
. . . than is possible by manual methods. Measurements are made by means of a rapid cross-wire motion said to have an accuracy of 0.01 in. The "Contact Telereader" handles single sheet or roll records of any length and any width up to 18 in. Measurements can be made between a trace and a base line, between two traces, or peak-to-peak on oscillatory traces. It handles both orthogonal records and records with curved ordinates. In addition, linear or non-linear calibrations can be applied electronically or graphically. Ordinates (calibrated or uncalibrated) can also be accumulated to provide mean values or areas. The output can be automatically digitized, stored, sequenced, and programmed by the manufacturer's "Telereducer-Program Unit" combination or a "Telecordex" to permit readout in typewritten form, perforated tape, and/or punched cards. Framework, a rigid cast frame mounted on a tubular base, can be adjusted vertically and angularly for comfortable operation. Viewing area is 30 x 18 in. Dial markings are —20.00 to 30.00 in. Full-scale dial ranges are: three revolutions for 30 in. on X-axis and 1.8 revolutions for 18 in. on Y-axis. Power input is 115 volts, 60 cycle A.C. Telecomputing Corp., 133 E. Santa Anita Ave., Burbank, Calif.

Circle No. **13** *on Reply Card*

New TEL-Aviation Mix Has Lower Blue Dye Concentration

. . . and has been designed specifically to meet U. S. Air Force standards. The new mix will permit refiners to dye military aviation gasolines more easily within the ranges of the recently announced new color standards. These standards were developed through the cooperative effort of the Air Force and the source of the new mix: Petroleum Chemicals Division, E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.

Circle No. **14** *on Reply Card*



Midget Vibration Motor Aids in Control of Spatula Dispensing

. . . for faster and more accurate laboratory weighings. With the new "Vibro-Spatula" particles can be dropped singly, or in a rapid stream, or in rapid bursts, onto the weighing scoop or paper. The motor fits into the technician's hand much like an electric razor, and vibrates the stainless steel spatula 60 times a second. In use, it is balanced on the fingers as easily as a conventional spatula; scooped into the sample; held over the pan; and the power turned on with a finger tap of the pushbutton switch. At the end of the dispensing, a few taps of the button will vibrate the last few crystals or particles into the pan. The tool uses 115 volt, 50-60 cycle A.C. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Penna.

Circle No. **15** *on Reply Card*

Horsepower in Line of Turbines Is Doubled in Newest Models

. . . of this horizontal steam unit. The DH-10 and DH-20 now have two instead of one steam nozzle, water-cooled bearings, and a maximum of four instead of three carbon rings. Models DH-30, DH-40, and DH-45 now have three nozzles instead of two and have a 50% increase in horse-

You can cut "UNACCOUNTABLE LOSSES!"

FIG. 2500 SERIES GAUGE HEAD

If your process involves the storage of liquids in tanks, then one of the first places to look for an "unaccountable loss" is in the gauging of your tanks.

"VAREC" Automatic Tank Gauging applies a new principle to a time-tested method of gauge operation that assures dependable accuracy and simplified reading. It will also save time and manpower. There is "VAREC" Automatic Gauging Equipment for high and low pressures and all gauging requirements.

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BELGIUM, Brussels	Etab. Emeric Kroch, 75 Blvd. Clovis
BRAZIL, Rio de Janerio	Sociedad Importadora de Equip., Av. Calogeras No. 15-7 S/708
CANADA, Montreal	Peacock Bros. Ltd. Town of La Salle
CANADA, Toronto	J. F. Comer Co., 508 Federal Bldg., 85 Richmond St. West
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HOLLAND, Amsterdam C	Comprimo N. V. Amstel 21C
JAPAN, Tokyo	American Japan Trading Co., 213 Chrom Ginza Chuo-Ku
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SWEDEN, Stockholm	Kemi-Intressen, P.O. Box 16363
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VENEZUELA, Marcaibo	Waldrip-Campbell, Apartado de Correo 594

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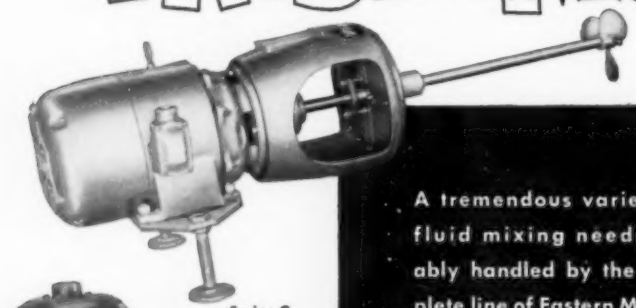
SOLVE YOUR MIXING PROBLEMS

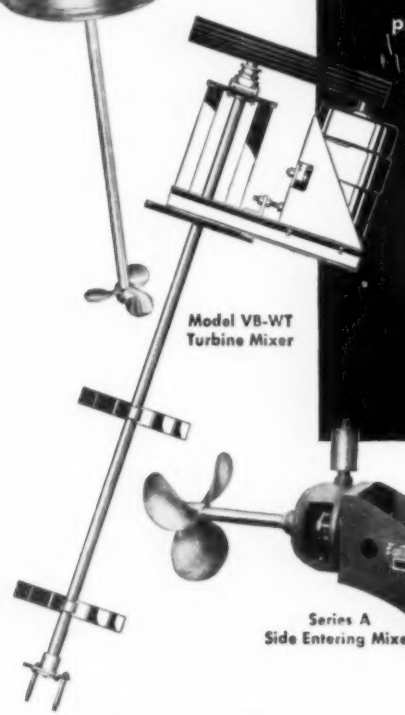


Series C
Side Entering Mixer

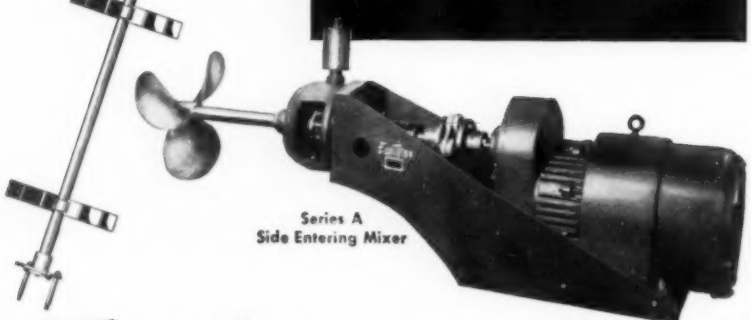
Series C
Top Entering Mixer

A tremendous variety of fluid mixing needs are ably handled by the complete line of Eastern Mixers. Size and power of mixers are flexible to help solve your problems. For complete information and engineering data, write for Eastern Fluid Mixing Catalogs. Eastern engineers are always available to work out your complex mixing problems with you.

EASTERN INDUSTRIES ★ MIXER DIVISION ★



Model VB-WT
Turbine Mixer

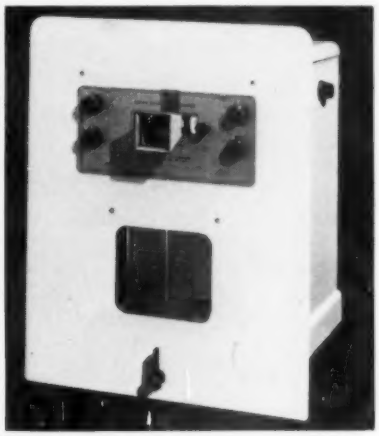


Series A
Side Entering Mixer

Eastern INDUSTRIES, INC.
Dept. F, Regent St., Norwalk, Conn.

power. A redesigned governor valve and trip valve has eliminated the need for packing on valve stems. The carbon ring improvement increased maximum back pressure from 50 to 75 psi. In the DH design, high pressure steam does not come into contact with the casing. All high pressure parts and joints are outside and visible to the operator. Maintenance is said to be easy even for unskilled operators. Dean Hill Pump Co., Dept. 1, 4000 East 16th St., Indianapolis 7, Ind.

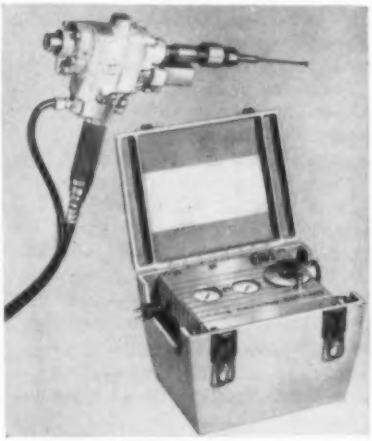
Circle No. **16** *on Reply Card*



Single-Pan Micro Balance Has High Accuracy at High Speed

. . . cutting weighing times from 5 minutes to 35 seconds. The new "Micro Gram-atic" Balance, of 20-gram capacity, has an accuracy of ±0.002 mg. It uses two instead of three knife edges, air damping instead of magnetic damping, and automatically registering weights. Weights are not added but are mechanically removed merely by dialing from the front panel. Sensitivity remains constant throughout weight range because all weighings are made under constant load. When a sample is placed on the pan, weights are removed by the knobs on the front panel, down to 0.01 gram of the sample weight, and are registered on the counter on the panel. The next, third and fourth decimal places are read from the projection system's ground-glass screen; the fifth and sixth decimal places are obtained by turning the optical micrometer. A metal front shield on the body of the balance protects it against heat from the operator's body. Built-in projection lamp for the micrometer uses both 115 and 230 volt, 50-60 cycle AC. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Penna.

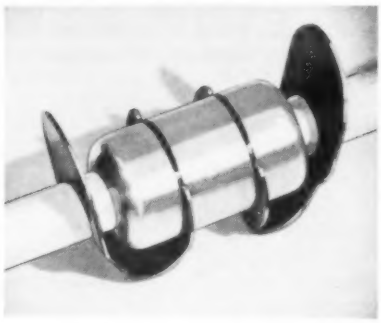
Circle No. **17** *on Reply Card*



Tube Roller Has Air Motor Combined with Electric Control

. . . to gain the advantages of each. The air motor gives fast rolling and permits the use of a single motor for a wide range of tube sizes, both ferrous and non-ferrous. It is capable of rolling ferrous tubes up to 2¼ in. I. D., making it adaptable to such equipment as heat exchangers, condensers, boilers, evaporators, coolers, dehydrators, etc. The control element insures the proper amount of tube expansion into the tube sheet so that tightness and holding strength are held to the amount required for the service. The control is designed to handle three sizes of "John Crane" air motors; Size No. 1 for non-ferrous tubing up to 1¼ in. I. D.; Size No. 2 for non-ferrous tubing up to 1½ in. I. D., and ferrous to 1¼ in. I. D.; Size No. 3 for ferrous tubing up to 2¼ in. I. D. Crane Packing Co., Dept. P12, 1800 Cuyler Ave., Chicago 13, Ill.

Circle No. **18** *on Reply Card*

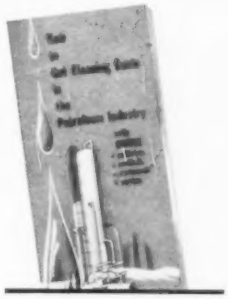


Spring-clip Device Adapted for Use as Connector for Tubing

. . . or pipe in a wide range of sizes. The new "Meca" Coupling requires no threading, flares, ferrules, or tools of any kind to make connections. One of

STORAGE TANKS

paint-stripped in less time—at less cost



SEND for this FREE Booklet. It is full of useful information on general maintenance . . . cleaning. Covers all divisions of the Petroleum Industry—production, processing, transportation, marketing.

BUT FAST—that's how old paint rolls off when you strip tanks the money-saving Oakite way.

Powerful Oakite strippers, applied by hot-flow-on, steam gun, or cold-flow-on method, actually float off paint, dirt and grease. You save time . . . no hand-scraping or chipping. You save money . . . long-life solution may be reclaimed and reused. No expensive sand blasting. And you're safe . . . no fire hazard.

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. . . *Technical Service Representatives in Principal Cities of U. S. & Canada* . . . . .

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HAMER *Plug Valves*
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the principles involved is grooving of the interior of the coupling. At each end are grooves containing rubber O-rings or Silicone or Teflon rings, depending upon the use. The sleeve is tapered on the inside to allow for any variation in the O.D. of the tubing. A stop in the center of the coupling allows insertion of the tubing to fit equally on each side. The spring clip grips tighter as pull pressure is applied. A variety of materials of construction will be made available to suit different applications. Master Enterprise Corp. of America, Boulder Bldg., Tulsa, Okla.

Circle No. **19** *on Reply Card*

Jacketed Equipment Line Now Includes Threaded Pipe, Fittings

. . . in sizes from ½ to 4 in. The complete line includes 90° and 45° elbows and tees. The manufacturer already is making a line of 125 lb. cast iron, 150 lb. steel, and weld end jacketed fittings as well as flanged, threaded, and weld end jacketed pipe. Red Jacket Co., Inc., Investment Bldg., Pittsburgh 22, Penna.

Circle No. **20** *on Reply Card*

Trade Literature

Audit & Analysis of Paperwork

. . . is offered by records' management council; brochure describes the service offered and benefits afforded. National Records Management Council, 60 East 42nd St., New York 17, N. Y.

Circle No. **21** *on Reply Card*

"Kel-F" Buyer's Guide

. . . lists molders and fabricators of "Kel-F" materials, firms offering corrosion control and other services, and a general directory of companies handling "Kel-F"; 16 pages. Technical Service, Chemical Manufacturing Division, M. W. Kellogg Co., P. O. Box 469, Jersey City 2, N. J.

Circle No. **22** *on Reply Card*

Fans and Blowers

. . . with and without adjustable pitch for cooling tower and heat exchanger use are described in *Bulletin A*-111. Photographs and brief details are provided for general line, shown in index form; specifications and greater detail for several types of adjustable-pitch fan. Hartzell Propeller Fan Co., Piqua, Ohio.

Circle No. **23** *on Reply Card*

Ammonia From Natural Gas

. . . plants, yield and cost data, principal operating features and the economics of a process design utilizing the high pressure of natural gas; 8-page booklet. M. W. Kellogg Co., 225 Broadway, New York 7, N. Y.

Circle No. **24** *on Reply Card*

Fluidized Feeder

. . . for handling solids in dense phase, in either process or material handling; brochure compares power needs with those of pneumatic feeder; solid to gas ratio said to be as much as 400:1, metering accuracy 3%. Sawyer Bailey Corp., 1559 Niagara St., Buffalo, N. Y.

Circle No. **25** *on Reply Card*

Insulation Measurements

. . . for 85% magnesia and diatomaceous silica table gives for each size pipe nominal thicknesses, actual thicknesses, which differ slightly to facilitate double layer construction, and the figure formerly used for each size. Compiled and distributed by the Magnesia Insulation Manufacturers Assn., 1317 F St., Washington 4, D. C.

Circle No. **26** *on Reply Card*

Electronic Proximity Meter

. . . which will compare, measure or monitor dimensions and distortions impossible to get at by mechanical means, with a sensitivity said to be about 0.01 micro-inch; 2-page bulletin describes this proximity meter-capacitance gage and its applications; with technical data. Fielden Instrument Division, Robertshaw-Fulton Controls Co., 2920 North Fourth St., Philadelphia 33, Pa.

Circle No. **27** *on Reply Card*

Laboratory Apparatus

. . . and equipment are illustrated and described in a new 16-page catalog, *No. LO*-1253. Included are several newly introduced items, e.g., a porous bottom crucible, new stirring apparatus and laboratory muller, and an all-purpose penetrometer. Full specifications provided. Schaar and Co., 754 Lexington St., Chicago 7, Ill.

Circle No. **28** *on Reply Card*

Filter Catalogue

. . . for determining the application and specifications for Niagara pressure-leaf filters; complete data on sizes, capacities and dimensions for both vertical and horizontal filters. *Catalogue NC*-1-53, Niagara Filters Division, American Machine and Metals, Inc., East Moline, Ill.

Circle No. **29** *on Reply Card*

Ion Exchange

. . . fundamental process and a brief history of synthetic resin ion exchange development; "Amberlite Ion Exchange" also presents 13 applications of ion exchange to industrial problems. Rohm & Haas Co., Resinous Products Division, Washington Square, Philadelphia 5, Pa.

Circle No. **30** *on Reply Card*

Stainless Steel Tubing

. . . is cataloged in *Bulletin S*-222; seamless and welded tubing is classified in separate tables according to standard tolerance, size and wall thickness; typical analyses; and technical and fabricating data. Globe Steel Tubes Co., Milwaukee 46, Wis.

Circle No. **31** *on Reply Card*

Florex—for adsorption

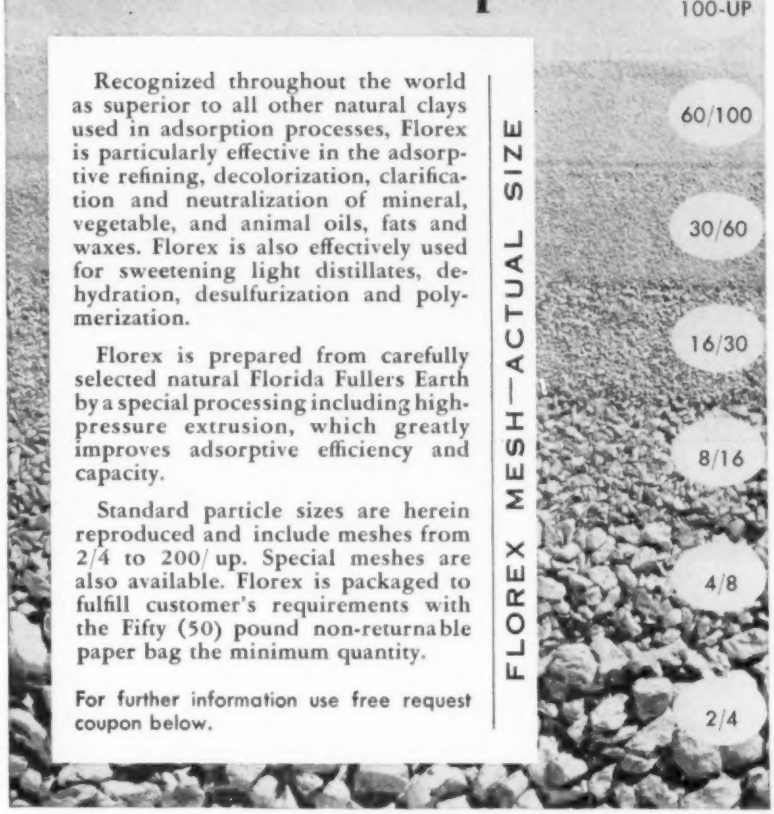
Recognized throughout the world as superior to all other natural clays used in adsorption processes, Florex is particularly effective in the adsorptive refining, decolorization, clarification and neutralization of mineral, vegetable, and animal oils, fats and waxes. Florex is also effectively used for sweetening light distillates, dehydration, desulfurization and polymerization.

Florex is prepared from carefully selected natural Florida Fullers Earth by a special processing including high-pressure extrusion, which greatly improves adsorptive efficiency and capacity.

Standard particle sizes are herein reproduced and include meshes from 2/4 to 200/ up. Special meshes are also available. Florex is packaged to fulfill customer's requirements with the Fifty (50) pound non-returnable paper bag the minimum quantity.

For further information use free request coupon below.

FLOREX MESH—ACTUAL SIZE



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Level Gages and Valves

. . . for petrochemical processing; 4-page folder pictures types and gives specifications. Ferguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.

Circle No. **32** *on Reply Card*

Rust-Inhibiting Coating

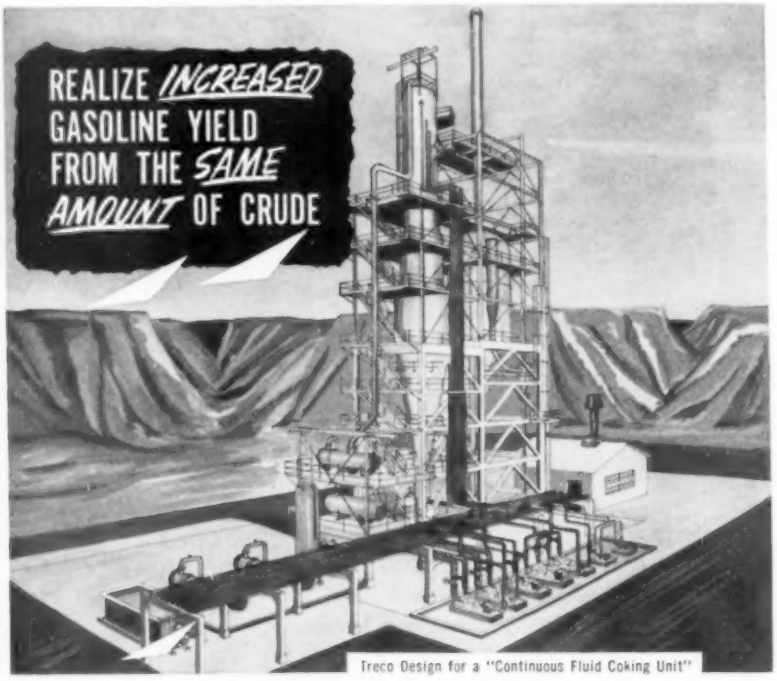
. . . for new or old steel and iron surfaces is dealt with in *Technical Bulletin* 5309; four pages describing "Rustmaster" and its typical applications and complete technical data. General Paint Corp., 2627 Army St., San Francisco 19, Calif.

Circle No. **33** *on Reply Card*

Preheating Combustion Air

. . . for process equipment is discussed in 12-page booklet; effect on fuel consumption, quality and quantity of production and maintenance costs is analyzed in graphs and charts. The Air Preheater Corp., 60 East 42nd St., New York 17, N. Y.

Circle No. **34** *on Reply Card*



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Increased gasoline yield from the same amount of crude, with more profits to the refiner, is but one result of "Continuous Fluid Coking"; a new process for coking heavy residual fuels developed by Standard Oil Development Company and offered to you by TRECO.

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Petroleum Processing Index

. . . for 1953: including subject and author indexes for all feature articles and regular departments for the 12 issues of this magazine published during the past year. Available now from McGraw-Hill Petroleum Publications, 330 West 42nd St., New York 36, N. Y.

Circle No. **35** *on Reply Card*

Pressure Loss Calculator

. . . for steam valves; slide chart estimates pressure drop and indicates proper size steam valve needed for any pressures up to 1500 psi.; full operating instructions and necessary technical data are printed on the calculator. Golden-Anderson Valve Specialty Co., 1264 Ridge Ave., Pittsburgh 33, Pa.

Circle No. **36** *on Reply Card*

Viscosity-measuring

. . . system consisting of a Brookfield Viscometran viscometer and a Foxboro "Dynalog" is covered in the 4-page technical report, *TI* 27-*A*-16*b*; gives operating principles of rotational viscometer and specifications for the system. The Foxboro Co., Foxboro, Mass.

Circle No. **37** *on Reply Card*

Refrigeration Condensers

. . . for ammonia and freon refrigerants; *Bulletin RC*-2 gives complete data for selection of small and large condensers and condenser towers; 38 pages and thoroughly illustrated with charts, diagrams and photos. Henry Vogt Machine Co., Louisville 10, Ky.

Circle No. **38** *on Reply Card*

Thermocouple Protection Tube

. . . of metal-ceramic construction is offered in *Bulletin P*1261; including physical properties and dimensions, and catalog order numbers of different types. Bristol Co., Waterbury 20, Conn.

Circle No. **39** *on Reply Card*

Flexible Metal Hose

. . . corrugated, convoluted and stainless steel types are described, illustrated with cut-away diagrams and given technical specifications; also, coupling equipment and installation information; *Catalog* 130*R*. Flexonics Corp., 1392 South Third Ave., Maywood, Ill.

Circle No. **40** *on Reply Card*

 (To obtain more data on advertised products see page 276)

What's New!

Oil and Gas Burners

. . . and accessories for furnaces and kilns; 28-page *Bulletin OB-53* covers burners for standard or wide capacity range operation, air registers, and fuel oil heating and pumping sets; contains a conversion table giving relationship between oil burned, boiler capacity and air required for combustion. The Engineer Co., 75 West St., New York 6, N. Y.

Circle No. **41** *on Reply Card*

Pressure Switches and Valves

. . . are described in 20-page *Catalogue* 3G; full data on manual control valves, selectors and shut-offs for vacuum or pressures up to 6000 psi., and solenoid controls for up to 3000 psi.; tabulation of most useful ranges of diaphragm, burdon tube and piston-actuated pressure switches. Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.

Circle No. **42** *on Reply Card*

Wobble-Rod Air Valve

. . . with integral exhaust for automatic, semiautomatic and manual control of pneumatic systems; *Bulletin* 61861 gives, in six pages, cross-sectional diagrams showing operation and specifications, a large photograph of the valve, drawings illustrating various hook-ups and applications, and details on operation and design features. Pantex Mfg. Corp., Box 660, Pawtucket, R. I.

Circle No. **43** *on Reply Card*

Ventilation Engineering

. . . information is provided in *Bulletin A-108*; fan laws and formulae, terms and definitions, recommended velocities for exhaust hoods, an air pressure conversion table, and charts covering duct resistance, entrance losses, and rectangular equivalents of round ducts are included; also, installation, maintenance and lubrication. Hartzell Propeller Fan Co., Piqua, Ohio.

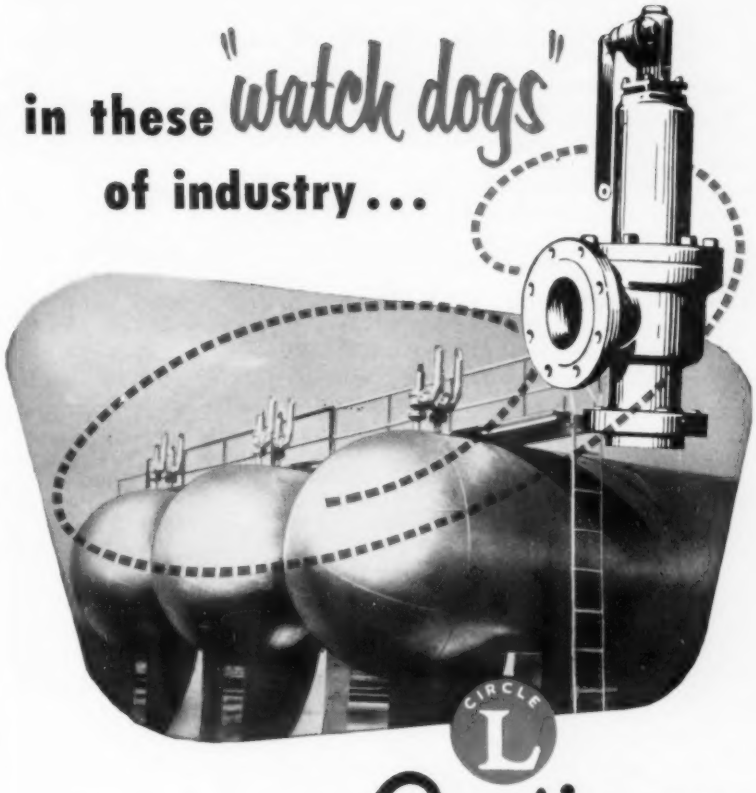
Circle No. **44** *on Reply Card*

Corrosion Resistance

. . . of manufacturer's stainless tubing and pipe products as shown under tests; *Technical Data Card* 160 gives resistance of five stainless Croloys to several hundred corrosive media at various temperatures and concentrations. Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa.

Circle No. **45** *on Reply Card*

in these "watch dogs" of industry...



LEBANON STEEL Castings are at work

SAFETY valves, those "watch dogs" of industry, are particularly important in chemical, refinery and power plants. Farris Safety and Relief Valves, for instance, are "on guard" 24 hours a day, protecting workers, protecting equipment, and assuring uninterrupted plant operations. Lebanon CIRCLE Ⓛ castings, important parts of these valves, are produced in several special alloys including CIRCLE Ⓛ-17*, a hardenable, corrosion-resistant, stainless steel with exceptional strength at elevated temperatures. Selecting these Lebanon casting materials added greater reliability to Safety and Relief Valves operating in lines handling steam, corrosive fluids and gases. These Safety and Relief Valves are manufactured by the Farris Engineering Corporation, Palisades Park, N. J.

Lebanon's experienced craftsmen produce castings in a wide range of materials . . . flexibility and control that provide truly dependable products.

*Lebanon's designation for Armco's 17-4-PH, produced under license by Armco Steel Corporation.

See—STEEL WITH A THOUSAND QUALITIES—37 min., 16 mm, semi-technical, full-color sound film on the making of steel castings. For information write: Dept. A, Lebanon Steel Foundry.

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Ultrasonic Thickness

. . . measuring instruments; 4-page folder gives different applications and types best suited to them. Branson Instruments, 430 Fairfield Ave., Stamford, Conn.

Circle No. **46** *on Reply Card*

Water Storage Vessels

. . . of every type and several purification and filtration installations are described and illustrated in *Catalogue* H20; includes details of designs, tables denoting sizes, capacities, etc. Hammond Iron Works, any plant.

Circle No. **47** *on Reply Card*

Cast Stainless Alloy

. . . with special heat and corrosion-resisting properties, 37% NI—17% CR; *Bulletin No.* 1 gives full specifications. Standard Alloy Co., Inc., 1679 Collamer Rd., Cleveland 10, Ohio.

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Thermocouples and Accessories

. . . *Bulletin* 235-5 gives specifications for standard thermocouples for all applicable temperature ranges; parts lists for each type of couple; installation diagrams for determining types of thermocouples needed for various furnaces, tanks, kilns and pipe lines; Foxboro Co., Foxboro, Mass.

Circle No. **49** *on Reply Card*

Vapor Sealing

. . . for low-temperature installations; 80-page, bound volume tells where and how insulation can be used to prevent corrosion from vapor; 54 illustrations. Insul-Mastic Corp. of America, 1141 Oliver Bldg., Pittsburgh 22, Pa.

Circle No. **50** *on Reply Card*

Did You Miss These?

The following items, reviewed originally in November, 1953, have aroused considerable interest among the readers. They are repeated briefly here as a service to those who might have missed them the first time. For details or literature, use the regular Reply Card in this issue.

Slide Calculator Helps Figure Values for Strength of Welds

. . . in range from 2,000 to 20,000 psi., and applied loads of from 9,000 to 450,000 lb. It has been designed for use by engineers and designers concerned with steel plate fabrication. A companion tool to the manufacturer's plate size selector, this new instrument is a durably-made plastic slide rule which indicates both size of weld needed for a given applied load and the weight of a given length of weld in lbs. On the reverse side of the calculator are basic design data for welded connections, plus formulas for calculating nominal properties of welded connections. Lukens Steel Co., Coatesville, Pa.

Circle No. **51** *on Reply Card*

New Fabrication Procedure In Jacketed Piping System

. . . eliminates need for steam or coolant jumpers and flanged joints, except where piping must be disassembled. The jacketed fitting combination consists of long and short radius, 90° "Tube-Turn" elbows, with their center line radii closely matching. On one

end of the inside elbow is a tangent that extends beyond the corresponding end of the outside elbow. On the other end of the inside elbow a short piece of pipe is attached to facilitate the installation work. The system is said to provide more accurate temperature control, minimize thermal expansion and contraction problems, permit optimum flow conditions, and reduce maintenance costs. Tube Turns, Inc., 224 East Broadway, Louisville, Ky.

Circle No. **52** *on Reply Card*

Gross Heat Output

. . . for all types of boilers, tanks, and heaters; information supplied in 24-page booklet to help in the proper sizing and selection of pressure relief valves; formulas and tables cover recommended valves for cast iron and steel boilers, as well as those for which there is no nameplate data or set procedures for establishing output. McDonnell & Miller, Inc., 3500 No. Spaulding Ave., Chicago, Ill.

Circle No. **53** *on Reply Card*

Pipe Pressure-Temperature

. . . ratings, more than 5000 of them, on the various grades of pipe commonly used in power plants; 28-page *Bulletin TB*1-1953. Pipe Fabrication Institute, 813 Clark Bldg., Pittsburgh 22, Penna.

Circle No. **54** *on Reply Card*

Cooling Tower Design

. . . and manufacturer's construction and operation principles; described and outlined in 36-page booklet; which also covers the company's services on installation, etc. Fluor Corp., Los Angeles 22, Calif.

Circle No. **55** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of Petroleum Processing to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item. Then fill in the rest of the card and drop it in the mail. No postage is required.

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EDITORIALS . . .

Useless Penalty on Industry

THOUSANDS of large consumers in the east and northeast would suffer from any arbitrary restrictions in the volume of imports of residual fuel oil, as is proposed by the coal interests and by some minority groups in the oil industry. A wartime effort to bring industrial fuel users in this area to convert to coal, to spare the oil for bunkering vessels, disclosed the hardships imposed on many types of consumers through changing fuels. The net result in oil conservation was very small, around 125-150,000 bbls. a day where even wartime economics justified the conversion.

The free competition between coal and oil, and now natural gas, has given many consumers a choice of the fuels they desire. There are today, however, numerous preferential users of residual fuel oil. Limitations on imports would cause them economic hardship in the form of much higher prices, if they could get the oil, or paying the cost of conversion to coal or some other fuel.

Vessel bunkers took 300,000 bbls. of the 1,509,000 bbls. of heavy fuel used daily in the U. S. in 1952. Ships as now built have no choice but to use oil. Space heating in large buildings used 216,000 bbls. daily. Their heating plant arrangements in many instances would make it difficult and costly for them to convert to coal. Manufacturing, including smelters and mining, consumed 433,000 bbls. daily of residual fuel in 1952. Some of this was for treating and other specialized uses where only oil would serve. Utility power plants, in many instances equipped to switch to other fuels should oil supplies be cut off, consumed only 193,000 bbls. daily.

The large volume of heavy fuel oil demand shown in these figures as going to preferential users indicates the difficulties they would encounter were up to 300,000 bbls. daily of imports arbitrarily cut off, as has been proposed. East and Gulf Coast refiners combined produce only about 500,000 bbls. daily of heavy fuel oil. Their plants could not make up for the loss in imports, even by disrupting their output of other products. Eastern industry would suffer greatly in the loss of heavy fuel oil imports, and the gain in coal consumption, through conversion from oil, would be of no economic importance. —V. B. G.

Here's a Challenge for Research

IF you're looking for a field of research in which there are tremendous possibilities—here's one for you. Find out how to increase the capacity of existing distillation equipment.

The petroleum processing industries are the world's largest user of distillation equipment. In refining alone, according to one source, the investment in such facilities now exceeds one billion dollars. It isn't hard to figure out, therefore, that a capacity increase of only a tenth of one per cent in existing distillation equipment would on the average be worth 10 million dollars. —W. F. B.

Has Smog Hit Your Town?

THAT portion of our population in the cities and industrial areas along the East Coast, from Maryland through the lower New England states, became personally aware of the smog problem during five or six days the latter part of November. Atmospheric conditions, and dust, smoke and fumes from various sources combined to create a blanket of heavy air at the street level that caused minor irritation of throat and eyes such as has plagued Los Angeles residents at times for some years.

This was the first occurrence of the phenomenon in this part of the country to receive general attention. Newspapers from Baltimore to Boston devoted columns to the resulting inconvenience and distress of the public. Editorials called attention of the air pollution authorities to the matter and the usually unruffled *New York Times* editorialized under the caption "Smoke—A Warning" and termed the atmospheric condition "a frightening thing."

As the industry is aware, the smog problem has existed for some time in the Los Angeles Basin area. Refiners there have studied what causes it and at considerable expense have installed means at their plants to lessen their contribution to the contamination of the atmosphere. The recent disturbances along the East Coast, however, come nearer home to a large part of the nation's population. The studies preliminary to remedial steps, which have already been announced by some public authorities in the area, will receive attention in other industrial districts. Having now been alerted to smog, the public will be more conscious of similar atmospheric disturbances in the future.

It is none too early for refiners in all industrial centers in the country to recognize that their own plants may at some time be charged with contributing directly to creating smog in their communities. They should prepare now for such a contingency. They should learn what public agencies in their own areas will concern themselves with this problem should it arise. They should be prepared to supply the authorities the basic factual data as to the causes of smog and the relative importance of various contributing factors. They should help in every possible way to bring a constructive approach to the problem, in place of its becoming a political issue.

Petroleum refiners are much better prepared in this matter than other industries. A National Committee on Smoke and Fumes was set up by the API Refining Division in 1952, chairmanned by W. L. Stewart, Jr., of the Union Oil Co. of California, who has had wide experience in the abatement program in the Los Angeles Basin. This committee has already undertaken a study of the technical problem connected with atmospheric pollution in cities and industrial centers. The potential field of activity of this committee now becomes much wider, for smog is a national problem for petroleum refiners. —V.B.G.

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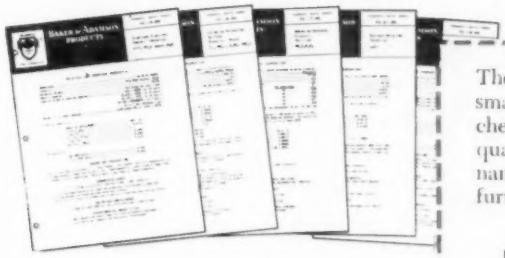

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☐ Aluminum Chloride, 32° Baume Solution	DA-83851
☐ Aluminum Fluoride, Powder, Technical	DA-32521
☐ Aluminum Nitrate, Crystal, Technical	DA-32341
☐ Aluminum Sulfate, Hexahydrate, Technical	DA-48871
☐ Ammonium Acetate, Crystal, Purified	DA-32711
☐ Ammonium Fluoborate, Crystal, Technical	DA-32731
☐ Ammonium Fluoride, Crystal, Technical	DA-32671
☐ Ammonium Oxalate	DA-33251
☐ Ammonium Sulfate, Purified	DA-33151
☐ Ammonium Thiosulfate, Solution, Technical	DA-85271
☐ Barium Fluoride, Technical	DA-34181
☐ Calcium Acetate, Powder, Purified	DA-34991
☐ Calcium Chloride, Anhydrous, Purified	DA-49211
☐ Calcium Chloride, USP	DA-35011
☐ Calcium Fluoride, Powder, Reagent	DA-35201
☐ Calcium Phosphide, Technical	DA-35341
☐ Chromium Fluoride, Technical	DA-35771
☐ Chromium Potassium Fluoride, Purified	DA-35791
☐ Chromium Potassium Sulfate, Granular, Photo	DA-35841
☐ Cupric Fluoride, Technical	DA-36481
☐ Cuprous Chloride, Technical	DA-36571
☐ Ferric Nitrate, Crystal, Technical	DA-37441
☐ Ferrous Ammonium Sulfate, Crystal, Technical	DA-37571
☐ Lead Nitrate, Crystal, Technical	DA-38371
☐ Magnesium Fluoride, Purified	DA-39121
☐ Oxamide, Purified	DA-48651
☐ Potassium Acetate, N. F., & Crystal, Technical	DA-40821
☐ Potassium Bifluoride, Technical	DA-41461
☐ Potassium Borate, Tetra, Purified	DA-40771
☐ Potassium Cyanate, Powder, Purified	DA-41591
☐ Potassium Cyanate, Powder, Technical	DA-48821
☐ Potassium Fluoborate, Crystal, Technical	DA-41361
☐ Potassium Fluoride, Anhydrous, Purified	DA-40911
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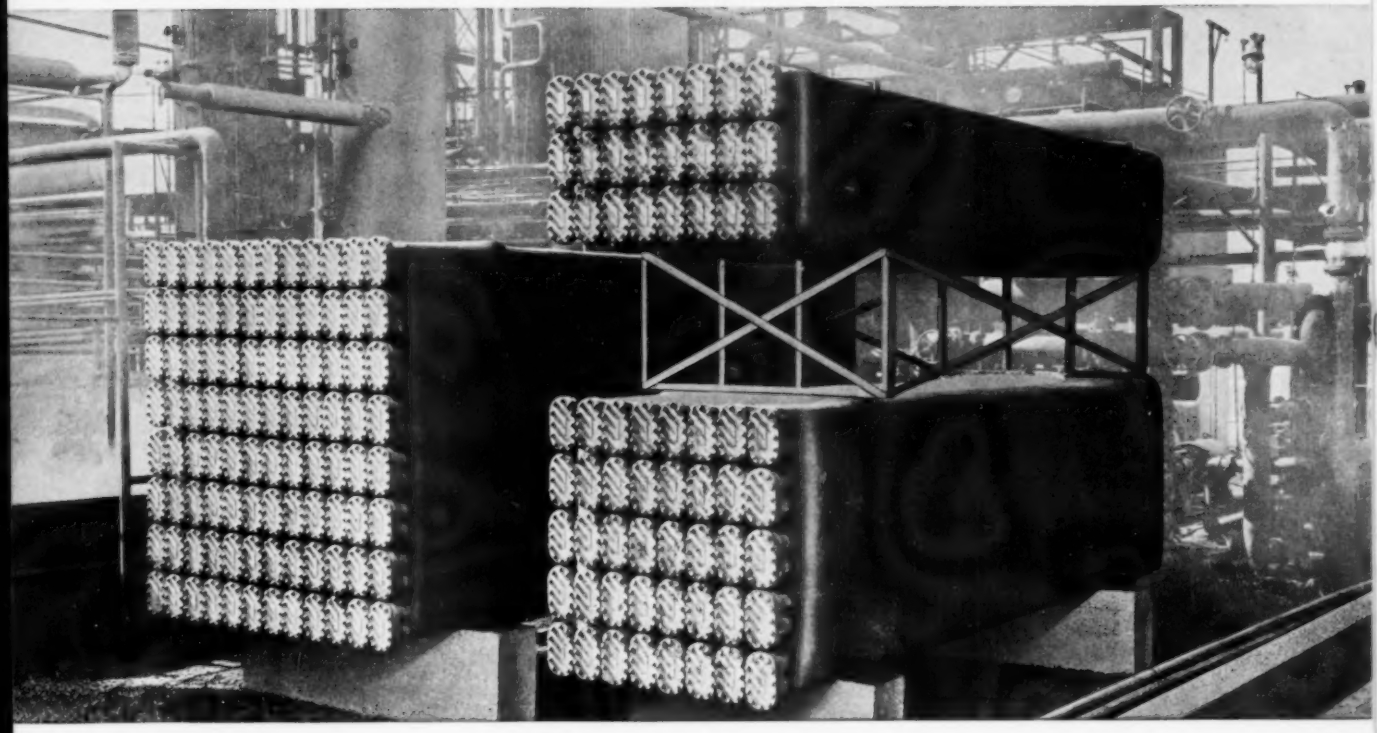

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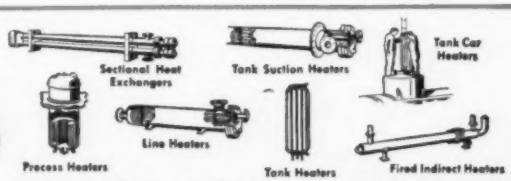

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